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ABSTRACT

Research sought to develop a quantitative model for the prediction of learning effects of a bilingual children's educational television program. The stimulus program series consisted of 30 sessions of Carrascolendas, a Spanish-English series which was based on specified behavioral objectives and aimed at students through grade 2. Learning effects were measured with criterion referenced tests administered to 408 Mexican-American children. Data were collected on the independent variables of communication stimuli, individual characteristics, and contextual traits; the predictive models were based upon linear multiple regression analysis. Results showed that learning effects can be predicted with relatively high degrees of reliability and accuracy. From this it was concluded that policy decisions regarding educational television must account for contextual characteristics, as well as program content and objectives, and that a communications stimulus, such as a television series, functions as one of many stimuli in producing learning effects. More detailed measures of these independent variables are needed and contracts for the evaluation of program series should require that measurement involve linear models. (LB)

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ON PREDICTING THE EFFECTS OF A BILINGUAL
CHILDREN'S EDUCATIONAL TELEVISION PROGRAM

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ON PREDICTING THE EFFECTS OF A BILINGUAL CHILDREN'S EDUCATIONAL TELEVISION PROGRAM

by

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Chapter I

Problem

Introduction

The aim of this study was to develop a quantitative model for the prediction of learning effects of a bilingual children's educational television program series. Both the theoretical and practical arguments for this study centered upon the need for a predictive model which simultaneously considers the characteristics of the individual student and the context of communication as well as the properties of the instructional communication he receives. These arguments were based upon the results of prior research on educational television and contemporary theorizing on communication, both of which suggest the need for multivariate models that incorporate mathematical precision.

The quantitative model in this study was developed through linear multiple regression analysis of data collected on 408 Mexican-American children at nine test sites across the nation. This data base was assembled during the national evaluation of the bilingual children's educational television program Carrascolendas. Produced by KLRN-TV at the University of Texas at Austin, Carrascolendas is aimed at a target audience of kindergarten, first and second grade Mexican-American children. It is intended primarily for viewing in the classroom as a supplement to bilingual education programs. The series consists of thirty half-hour programs

broadcast in color during the course of a single semester. Each program is designed to promote learning of pre-specified instructional objectives. The programs consist of a number of generally active, fast-paced segments of songs, dramatic skits, animated sequences, and other techniques structured to hold the viewer child's interest and stimulate learning of the concepts being presented. The series is unified by a central cast of characters and the setting of an imaginary town from which the program series derives its name, Carrascolendas.

Research Questions

Given the instructional communication materials and the data base identified above, this study attempted to answer the following questions:

(1) To what degree can learning effects be predicted upon the basis of characteristics of the instructional communication treatment, the individual student characteristics, and the contextual variables?

(2) If a reliable model for predicting learning effects can be developed: (a) What are the practical implications for policy decisions on children's bilingual educational television? (b) What are the implications for theorizing about the communication effects of educational television?

A Paradigm for Communication Research

The current trend toward multivariate research on

communication is reflective of a general pattern in social and behavioral science research. Within the framework of cost-effectiveness and governmental funding during the past decade of social programs such as Head Start and Model Cities, a great deal of research has concentrated on program evaluation (Alexander, 1972; Rossi & Williams, 1972). Research on these programs has evolved from simple notions about cause-effect to multivariate views. Poverty, for example, was once cited as the direct cause of crime; programs which raised income levels should consequently lower crime rates. Such has not been the case (Alexander, 1972, p. 140). Alexander points out that theorists and researchers alike have begun to realize that a fundamental inadequacy in early research was a failure to discern, measure, and account for the "multitudinous interacting influences on social behavior [p. 133)."

Evaluation and accountability have also had a heavy impact in education (Coleman, et al., 1966). The contracts for educational television programs supported with government funds, such as Sesame Street and Carrascolendas, more often than not currently require empirical evaluation of the impact of the program. This evaluation research suffers from the same problems of accounting for multivariate influences as research on the evaluation of other types of social programs. Unfortunately the traditional research paradigms, developed in experimental laboratories and usually incorporating analysis-of-variance designs, have not been

entirely adequate for the task.

The research paradigm adopted in the present study incorporated at the outset the assumption that learning effects produced in part by educational television are also influenced by a variety of receiver and contextual characteristics. In addition, the statistical technique of multiple regression analysis was assumed to provide an adequate mathematical tool for the construction of a multivariate predictive model.

Communication Theory and Research

Contemporary theorizing on mediated communication views the media as operating amid a nexus of causes in producing effects (De Fleur, 1970; Rogers & Shoemaker, 1971; Schramm & Roberts, 1971). This view has evolved from an extensive body of research conducted principally on attitudinal effects of mediated communication. Excellent, extensive reviews of this research are available, particularly in Weiss (1969) and Roberts (1971). The key stages in the development of the multivariate view of communication and attitude change are summarized here because these theories have often been applied to research on learning effects of educational television. The multivariate view of communication represents considerable change from earlier simple stimulus-response approaches.

The earliest models used by behavioral scientists in their research on communication was basically a stimulus-response theory, embodied in the "hypodermic needle" model of communication.

The media were viewed as a simple stimulus which directly acted upon a passive, homogenous audience of receivers to produce the effect. This direct effect view of communication, however, was too simple and too superficial to account for the variety of different responses found by communication researchers (Rogers & Shoemaker, 1971). At first theorists attempted to account for differences in response to communication by recognizing individual psychological differences. This slight change in theory was still inadequate. Eventually a variety of social variables was incorporated into views of the communication process, and this was known as the "two-step" flow model of communication (Rogers & Shoemaker, 1971, p. 205). In this model the mass media were seen as influencing opinion leaders, who in turn influenced less active members of the audience. The two-step flow model quickly evolved into the multi-step flow model and generally into a theory of mediated communication which accounted for a variety of social categories and social relationships. The consistent generalization threading throughout current theorizing on mediated communication is that receiver and contextual variables typically interact with message and channel variables in producing effects.

Research and theorizing on educational television has generally lagged somewhat behind research on attitude change. Until the late 1960's, research on educational television consisted primarily of comparative studies of televised as against conventional instruction. These studies mostly followed the

hypodermic needle model of communication. One group of students was exposed to an educational television program, and another group to a classroom teacher. The measure of effects was generally the subject area test customarily administered to the class of students under consideration. Responses to the effects measure were tested to determine whether the stimuli produced significantly different effects. The most frequent finding of 425 comparative studies reviewed by Schramm (1962) was that classes taught by educational television revealed no significant difference on subject area tests from classes taught by conventional methods. Where significant differences were found, however, there was seldom any clear indication of the reasons for these results. After many comparison studies had been accumulated and reviewed, Schramm (1962) concluded that television was generally found to be more successful among the lower elementary grades than in high school or college studies, and television was more frequently successful in studies of science or mathematics instruction than in studies of instruction in the humanities or literature. In reviewing many of the same studies, Williams (1962) suggested that the attitude, ability, and personality of the teacher might be an important missing variable in accounting for the learning effects of educational television.

Two main conclusions have generally emerged from the comparative studies (Chu & Schramm, 1968): (1) Educational television could be as effective a medium for teaching as conventional

methods. (2) Older students (high school and college level) generally express unfavorable attitudes toward educational television. These broad summary findings give some indication that the impact of educational television is influenced both by audience and contextual variables as well as by the content of the television program. Theorists such as Allen (1971), Gagné (1970), Kittross (1969), and Schramm (1962), have stressed repeatedly the need for multivariate research on educational television. Schramm's (1962) statement, although now more than a decade old, is still relevant to contemporary research on educational television:

> The pertinent question is no longer whether the teacher can teach effectively on television, but rather how, when, for what subjects, and with what articulation into classroom activities [educational] television can more effectively be used [p. 165].

In answer to the need for theory and research on educational television which accounts for the multivariate nature of communication and learning, the current state of the art is quite limited. Only generalizations linking two or three variables are possible, such as the statement that the use of visual images will improve the learning of manual tasks (Chu and Schramm, 1968). As De Fleur (1966) has observed, generalizations stated in terms such as "will improve," "may alter," and "often" need to be replaced by statements of "appropriate mathematical functions and statements of probability [p. 139]." Kittross (1969) and Schramm (1971) have also emphasized the importance of models which provide

for the prediction of outcomes based upon observable relationships and conditions. While the construction of such models has not been attempted in research on educational television, a statistical tool useful for the construction of the needed models exist in multiple regression analysis.

Multiple Regression Analysis

The essential concepts of multiple regression analysis provide insight into the applicability of this technique in the present study. One of the most basic concepts is that a subject's scores on one measure can be reliably predicted from his scores on other measures.

The reasoning in the present study is that performance test scores can be predicted from a weighted combination of measures of communication stimuli, individual receiver characteristics, and contextual characteristics. For example, a student's test score might be expected to vary according to the number of educational television programs he views, his grade level, and the amount of bilingual instruction he is given. In natural language it might be said that these factors influence the student's response to test items and thus contribute to or detract from his test score. If information about these factors is known, then the student's test score could be predicted from this information.

In mathematical terms, the prediction equation would be of the form:

$$\text{Test Score} = (a_1)(\text{Viewing Frequency}) + (a_2)(\text{Grade Level}) + (a_3)(\text{Bilingual Instruction [hours/day]}) + (\text{Error})$$

In this equation the a_1, a_2, and a_3 are the weights on the three measures used to predict test score. These measures are selected examples of communication stimuli, receiver characteristics, and contextual characteristics. The error term is the difference between the predicted test score and the test score actually observed. Multiple regression analysis is used to reduce the data from a sample of subjects to a single generalizable equation.

The basic research paradigm of the present study was one of model-seeking. The goal of the analysis was the construction of a mathematical equation representing the optimum multivariate model for predicting specified communication effects. The effects of interest in the present study were the stated objectives or effects expected to result from viewing the educational television program series Carrascolendas. Selection of independent variables used to predict effects was guided by the results of prior research on Carrascolendas and a similar series, Sesame Street.

Prior Research

Sesame Street Research

In 1968 the Children's Television Workshop began an innovative program of research, production, and evaluation for the educational television program Sesame Street (Palmer, 1969). One

key assumption was that the producers of Sesame Street accepted at the outset the burden of gaining the attention and interest of their target audience. This represented a departure from the vast majority of prior educational television projects, which generally assumed a captive classroom audience. The research activities connected with Sesame Street were an integral part of the development, production, and evaluation of the program series. Departing from the assumptions and methods of comparative studies of educational television, the aims of Sesame Street were identified in terms of educational objectives and such responses as attention, motivation, comprehension, and the like. These objectives were stated as specified behaviors which could be readily observed and measured. Evaluation research and production on Sesame Street also attempted to take account of both audience and content variation (Ball & Bogatz, 1970). The target audience was defined generally as preschool children, aged 3-5, and more specifically as disadvantaged, urban children. The behavioral goals of the program were originally formulated with reference to the target audience, but some formative research was conducted to determine baseline data. These data were then used as reference points for deciding whether the initial statement of behavioral goals was realistic or was inappropriately high or low. Given refined statements of the behavioral objectives, the task of evaluation was then one of selecting samples of children and developing and applying instruments which gauged the specified

behaviors.

First year research. The first summative evaluation of Sesame Street included the following main question (Ball & Bogatz, 1970, p. 6):

1. Do viewers learn more than nonviewers?
2. Among viewers, which children learn least, and which children learn most?
3. What is the program's effectiveness among subgroups (e.g., lower-middle class, boy-girl, Spanish-English speakers)?

The evaluation design involved sampling four populations of children, with emphasis on the first type:

1. Disadvantaged; inner city
2. Advantaged; suburban
3. Advantaged and disadvantaged; rural
4. Disadvantaged; Spanish-speaking

Test site selections were limited by a number of criteria, including: (1) the area had to be served by a VHF (rather than UHF) educational television station; (2) the station had to agree to telecast Sesame Street at 9:00 or 10:00 a.m.; (3) the site had to contain a large number of disadvantaged, inner city children; (4) there had to be a local, competent field staff available. The five sites selected were Boston, Massachusetts; Durham, North Carolina; Phoenix, Arizona; suburban Philadelphia, Pennsylvania; and a rural area in northeastern California.

In these sites subjects were selected from Head Start classes (in-school subjects) and at-home children, primarily on the basis of the child's socio-economic status. Within each sample, children were randomly assigned to treatment conditions, encouraged or not encouraged to view Sesame Street and observed or not observed by field staff while viewing. Although 1124 children participated in the evaluation, only 943 completed both pretest and posttest.

The tests had undergone an extensive period of development and were criterion referenced, i.e., the tests were designed to measure the behaviors which were the specified goals of the program series. Attempts were made to provide a familiar environment for testing with a relatively short test duration. The general technique consisted of three steps. A picture or object was shown to the child; the picture was described; and the child was asked to respond (usually by pointing) to a question about the picture or object.

Results of the first year's evaluation may be summarized as follows:

1. Viewers learned more during the progress of the program series than nonviewers.

2. Consistent viewers learned far more than occasional viewers, with at-home viewers suffering no disadvantage in comparison with in-school viewers.

3. Amount of viewing did not interact with sex, that is girls did not gain more or less than boys at each viewing level.

4. Differences in gains for children from different social status were tied to prior achievement. Prior achievement was, in turn, confounded with amount of viewing. Children with high pretest levels generally gained less, since they already knew much of the program's material. Children with low prior achievement benefited most from increased viewing of the program.

A separate analysis was conducted on data from 43 Mexican-American children who viewed Sesame Street at home in Phoenix, Arizona. Since some of these children had relatively lower fluency in English, the children were tested, when necessary, in Spanish by bilingual test interviewers. Results were not analyzed, however, in terms of the language of the test interview. These children were further divided into quartiles according to their frequency of viewing Sesame Street. Children were assigned to one of the four quartiles as follows:

(1) Children who rarely or never watched the program (N=14).

(2) Children who watched an average of 1 to 3 times a week (N=11).

(3) Children who watched an average of four to five times a week (N=7).

(4) Children who watched an average of more than five times a week (N=11).

For all quartiles, pretest scores were low as compared with other groups of children in the national evaluation. The

gains of Mexican-American children in quartile 4 (high frequency of viewing) gained an average of 37% from pretest to posttest. This gain was larger than that of any other group in the national evaluation. As with other groups, increased frequency of viewing resulted in greater gain from pre to posttest. The more frequently the child viewed the program, the greater was the program's impact.

Frequent viewers did not differ appreciably from infrequent viewers in terms of mental age or socio-economic status. Frequent viewers, however, more often had parents who usually read to them and had mothers who talked with them about Sesame Street. These related or supplementary activities appeared to be more important moderating influences on the impact of viewing the program than mental age or socio-economic status.

These conclusions were considered tentative, since the number of Mexican-American children (43) who participated in the study was relatively small. An effort was made in the second year to replicate the results of the first year's testing (Bogatz & Ball, 1971). A group of 66 children from Spanish backgrounds was sampled in Los Angeles and randomly assigned to encouraged and not-encouraged treatment conditions. For unreported reasons, however, the treatment and control distinctions broke down, with nearly all of the children viewing the program series. Results were inconclusive and no replication of the findings of the first year was possible.

The results of the first year's evaluation not only provided a basis for defining the success of the program, but were further useful in diagnosing the first year's effort. For example, the evaluation raised such concerns as whether the curriculum was a poor preparation for learning to read; whether the goals of the program were too narrowly conceived, thus more greatly assuring success, whether the program was adequately oriented to the culture of Spanish-speaking children, and whether sequences which attempted rote learning could be improved.

Second year research. Evaluation during the second year consisted of a "New Study" and a "Follow-up Study" with the following questions (Bogatz & Ball, 1971, p. 29):

1. Can the findings of the first year be replicated? (The "New Study")
2. What are the effects of the revised sites and curriculum? (The "New Study")
3. Were the first year's effects cumulative? (The "Follow-up Study"--longitudinal)

The New Study concentrated mainly on at-home, urban, disadvantaged children, representing the main target population. Two new sites included 283 children who had not seen Sesame Street during its first year. The Follow-up Study retained three disadvantaged urban sites (283 children). New items and tests were developed to assess the new goals; old items and tests were included to measure the effectiveness of old goals on new viewers.

Again, the study involved testing groups of children who could be divided into viewer-nonviewer populations.

The results of the second year evaluation for the New Study supported the first year findings of goal effectiveness for disadvantaged preschool children. Goal effectiveness is described as impact on, rather than perfect mastery of, goal behaviors. The general results revealed that disadvantaged preschoolers continued to benefit from the show's emphasis on basic knowledge and skills, and older and more advantaged children benefited from the presentation of more complex knowledge and skills. Results of the Follow-up Study showed greatest effects in the cognitive domain. Since most of the first year's material was learned in the first year, it was deemed necessary to introduce new goal areas each year in order to have a continuing educational impact on children viewing the series for more than one year.

A dividend of the research on the Sesame Street series has been that it provides a basis for expanding the kinds of questions which may be raised about the effects of educational television, as well as making such questions more precise. For example, one question raised by the results of the Sesame Street evaluation concerns the effects of the viewing environment upon learning gains. Children who viewed Sesame Street and had the opportunity to interact with their mothers about the program demonstrated greater gains than other children. The child seemed to become a more active educational participant if circumstances

prompted him to use items learned from the program, such as the use of related toys or some type of interchange with parents or peers. A more general question is how, with any type of educational series, supplementary activities can be encouraged at home or at school and what influence such activities have on learning effects resulting from viewing the program series.

An expansion of questions raised in the evaluation of Sesame Street concerns the effects of viewing an educational television program series on Mexican-American children. Research on the first year of Sesame Street indicated that among Mexican-American children, increased frequency of viewing the series resulted in increased learning effects, and that these effects were somewhat moderated by environmental influences. However, the unfortunate failure of the replication attempted during second year research leaves the answers somewhat inconclusive.

Carrascolendas Research

Again, the educational television program series Carrascolendas was designed specifically to meet the needs of bilingual kindergarten, first, and second grade Mexican-American children. It was initiated in July, 1970, as a special bilingual program project of the Education Service Center, Region XIII (Austin, Texas). The content of the series was designed at the outset to reinforce and supplement existing classroom bilingual instructional programs. Produced by the University of Texas at Austin

educational television station, KLRN-TV, Carrascolendas has incorporated a variety of presentational techniques such as films, puppets, and dramatic skits and is similar in format to Sesame Street. Also like Sesame Street, the producers of Carrascolendas accepted the burden of attracting and maintaining the attention of their target audience. The content of the program series was developed around specified behavioral objectives. For two years Carrascolendas was broadcast (and evaluated) only in the state of Texas. In its third year the series was broadcast nationally through the Public Broadcasting System.

In the first two years of evaluation research on Carrascolendas, only Mexican-American children in an Austin, Texas, school were included in experimental studies (Natalicio & Williams, 1971; Williams, McRae, & Van Wart, 1972). In the third year research, when Carrascolendas was nationally distributed, subjects were drawn from test sites in Arizona, California, Colorado, and Michigan, in addition to Texas (Williams, Van Wart, & Stanford, 1973).

The same type of research design was used in the experiments for each of the three years. Test instruments were developed to measure a sampling of the behavioral objectives of the series. Groups of children were selected to participate in the experiment and were designated as viewers or nonviewers. Before viewing the series all children were given oral interview tests, separately in Spanish and in English. Viewers then watched the

series which usually consisted of 30 half-hour programs broadcast three times a week. After viewing the series, both groups of children were given the same test materials. Gain scores (post-test minus pretest) were compared to see whether there were differences between viewer and nonviewer groups. Differences, when found, were interpreted as indicative of the effects of the program.

In all three years, behavioral objectives were specified for several content areas.[1] Analyses were conducted on subtest scores in each content area, as well as on total test scores for both Spanish and English testing. The content areas were tested in both languages as follows:

Self Concept

Science (Labeled as Physical Environment during the first year)

History/Culture (Labeled as Multicultural Social Environment during the first year)

Language Skills

Math (Labeled as Concept Development during the first year)

In addition, one other content area was tested only in Spanish--Phoneme/Grapheme Relations.

The first two years--Austin, Texas, evaluations. In the

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[1]Detailed examples of each content area are given in Chapter Two.

first year's experiment Mexican-American children from bilingual and traditional classrooms in first and second grades from one Austin, Texas, school were randomly selected for assignment to viewer or nonviewer groups. Eighty-eight children were included in this study, 48 viewers and 40 nonviewers. Subdivisions by grades and type of classroom were equal within the viewer and the nonviewer groups. Children in the nonviewer group were provided with an alternative activity in the form of a photography project. The viewing group received a selected set of activities before the program, viewed the program, and then usually engaged in follow-up activities. In both pre and posttesting, approximately half of the children received the English interview test before the Spanish one, and vice versa, to avoid order effects. The pre and posttest interviews conducted with each child were always separated by a period of several days.

Research conducted during the second year's evaluation was basically the same as during the first year. Children in the same Austin, Texas, school were again selected for participation in the evaluation experiment. In the second year experiment, however, the 44 children were selected only from the first grade and were randomly assigned to one of three treatment groups: (1) viewers who had supplementary classroom activities relevant to the program series; (2) viewers who had no classroom activities directly relevant to the program; and, (3) a group of children who were nonviewers. Again, the nonviewer group was engaged in a

photography class during the period that the Carrascolendas programs were on the air. Test instruments used during the second year were also criterion referenced measures. These test instruments represented samplings of the behavioral objectives of the second year program series, which was a new series different from that broadcast during the first year.

Table 1 summarizes the results of the first two years of evaluation research.

The results of the first year's experiment revealed significant viewer-nonviewer differences in English testing, but not in Spanish testing (Natalicio & Williams, 1971, pp. 29-33). The findings were generalizable across traditional and bilingual classrooms and across first and second grades. Results were different, however, across content areas, with significant differences found only in English testing of Science and Math.

The general results of the second year's experiment were reported in terms of scores representing the percentage of correct responses made by subjects (Williams, McRae, & Van Wart, 1972, pp. 14-15, 19-21). As can be seen in Table 1, a varying pattern of results is again exhibited across content areas.

Scoring procedures used during the second year were somewhat expanded from those used during the first year. Whereas in first year testing the children's responses were scored only as right or wrong, in the second year responses were also weighted to indicate degree of correctness, as follows: (1) a correct,

Table 1

Results of the First Two Years
of Carrascolendas Evaluation

	First Year	Second Year
Spanish Areas		
Self Concept		*
Science		
History/Culture		
Language Skills (Spanish)		*
Math		
Phoneme/Grapheme		
Total		
English Areas		
Self Concept		
Science	*	
History/Culture		*
Language Skills (English)		*
Math	*	
Total	*	*

*Significant viewer-nonviewer difference ($p < .05$).

umprompted response was weighted "4"; (2) a correct, but prompted response was weighted "3"; (3) a partly correct response received a "2"; and, (4) an incorrect or no response was given a "1".

Additional analyses were conducted on Math items and activity-nonactivity items, using average scores which ranged from one to four. An average score was computed for each child based upon the weighted scores for relevant items. The varying results of testing in different languages is particularly obvious from the analysis of average Math scores (Table 2), where in Spanish testing viewers without activities exceeded other groups in gains, while in English testing viewers with activities were superior. A similar pattern is evident in the analysis of activity-nonactivity items (Table 3), although the gains of viewers with activities generally exceed other groups.

The results of the analysis of scores on Math items and on activity-nonactivity items taken together indicate that the language of the test interview is an important consideration in research on educational television for Mexican-American children and that supplementary activities as well as program viewing produce learning effects among the children.

The third year--national evaluation. The generality of learning effects produced by program viewing was shown in research conducted on a national basis during the third year of Carrasco-lendas evaluation activities. Again, the research design, testing, scoring, and analysis procedures were generally the same as

Table 2

Average Scores in Response to

Math Items in Second Year Testing

	Posttest Scores	Difference from Pretest Scores[1]
Spanish Test:		
Viewers with activities	2.6	0.5
Viewers without activities	2.6	0.9
Nonviewers	2.4	0.5
English Test:		
Viewers with activities	3.1	0.8
Viewers without activities	2.8	0.4
Nonviewers	2.8	0.5

[1]Significant difference in gains among groups ($p<.05$) in both Spanish and English testing.

Table 3

Average Scores in Response to Content Items Involving or not Involving Class Activities

	Posttest Scores	Difference from Pretest Scores
Activity Items [1]		
Spanish Test:		
Viewers with activities	2.7	0.5
Viewers without activities	2.6	0.6
Nonviewers	2.3	0.1
English Test:		
Viewers with activities	2.9	0.7
Viewers without activities	2.6	0.3
Nonviewers	2.6	0.3
Nonactivity Items		
Spanish Test:		
Viewers with activities	2.8	0.5
Viewers without activities	2.7	0.4
Nonviewers	2.7	0.2
English Test:		
Viewers with activities	2.9	0.7
Viewers without activities	2.6	0.3
Nonviewers	2.4	0.1

[1]Significant difference in gains among groups ($p<.05$) in both Spanish and English testing of Activity Items.

used in the second year evaluation. Subjects for the third year experiment, however, included Mexican-American children in the following test cities:

Albuquerque, New Mexico
Edinburg, Texas
Lansing, Michigan
Los Angeles, California
Pueblo, Colorado
San Antonio, Texas
Tracy, California
Tucson, Arizona

In this national evaluation, Mexican-American children were selected from kindergarten as well as first and second grades and were assigned to viewer or nonviewer groups. The Pueblo site had an additional group of Anglo subjects in kindergarten, first, second, and third grades who received the posttest measurement only in Spanish, although both pre and posttests in English were administered. If any subject did not view at least twenty of the first 27 programs (only objectives presented in the first 27 programs were tested), he was eliminated from the analysis. Elimination of these subjects reduced the total number of viewers posttested for statistical comparison. The experiment was completed by a total of 340 viewer and 106 nonviewer subjects in Spanish and 341 viewers and 106 nonviewers in English.

Two sets of analyses were conducted on data collected during the third year's experiment. One set of analyses was conducted

on total test scores and content area subtest scores combining viewers or nonviewers from all sites (Table 4). The other analyses were conducted on total test scores of viewer-nonviewer groups at each test site (Table 5).

These results indicate that children in different grades respond differently to the program series, and that children in different geographic locations across the nation respond differently to items presented on the program series (and subsequently tested) in Spanish or in English. The influence of the viewing environment on learning effects among children, noted above in Sesame Street research, is evident in the third year Carrascolendas research by the differential response of children in different cities. The environmental factors which produced this differential response were not investigated in the third year Carrascolendas evaluation; but, the results of Sesame Street research and the second year Carrascolendas research point strongly to the variable of supplementary activities as one influential environmental factor.

The results of analyses of responses according to content area also confirm the findings of earlier evaluations. There is a differential pattern of responses among content areas, with the most salient gains in the content area of History/Culture and the least in Phoneme/Grapheme Relations.

Viewed across the three years of evaluations, the results exhibit a pattern sensitive to content area, grade level, school

Table 4

Third Year National Results

Test	Kinder-garten	First Grade	Second Grade	Combined Grades
		Spanish		
Self Concept		*		
Science				
History/Culture	*	*	*	*
Language Skills		*		*
Math		*		*
Phoneme/Grapheme				
Total		*		*
		English		
Self Concept	*			
Science	*			*
History/Culture		*		*
Language Skills	*	*		*
Total	*	*		*

*Viewer gains significantly greater than nonviewer gains ($p<.05$).

Table 5

Third Year Site Results

Site	Spanish Test				English Test			
	Kinder-garten	First Grade	Second Grade	Combined Grades	Kinder-garten	First Grade	Second Grade	Combined Grades
Albuquerque, NM[a]	*							
Albuquerque, NM[b]		*		*				
Edinburg, TX	*			*	*			*
Lansing, MI								
Los Angeles, CA							*	*
San Antonio, TX[a]						*	**	
San Antonio, TX[b]								*
Tracy, CA					*		*	*
Tucson, AZ								
Pueblo, CO[c]		*		*	*			
Pueblo, CO[d]						*		

[a]Site with bilingual curriculum
[b]Site with monolingual (English) curriculum
[c]Site with Mexican-American subjects
[d]Site with Anglo subjects
*Viewer gains significantly greater than nonviewer gains ($p<.05$)
**Nonviewer gains significantly greater than viewer gains ($p<.05$)

differences, and language of testing. Where effects are measured relative to the behavioral objectives of the program series, the series appears to have its greatest impact in the area of History/Culture and Language Skills among first grade viewers who participate in supplementary classroom activities relevant to the program content. The total test score appears to be an ambiguous measure, whereas content area subtests yield more specific information. Significant viewer-nonviewer differences, furthermore, are found more frequently in English than in Spanish testing.

Given that effects of viewing an educational television program can be measured and that such effects vary according to program content, viewer characteristics, and school differences, the question is to what extent are effects predictable from such information? If effects can be reliably predicted, then what are the more salient predictive factors? The collection and analysis of data aimed at answering these questions is discussed below.

Chapter II

Program Materials and Data

Description of Program

The program materials represented in this study consisted of the third-year series of Carrascolendas. This series was originated as a special bilingual education project supported by Title VII funds. The series was produced by KLRN-TV at the University of Texas at Austin under the production supervision of Ms. Aida Barrera.

The content of Carrascolendas was designed to reinforce and supplement existing classroom bilingual instruction programs, while taking advantage of the unique opportunities offered by the television medium. The series incorporated a broad range of presentational techniques such as actors, puppets, films, music, dance, and special effects to provide innovative, attractive, and entertaining enrichment of classroom activities. In the development of program material, emphasis was placed on bilingualism, Mexican-American culture, the Mexican and Spanish heritage and the multi-cultural society of the United States. Throughout the series the Spanish language, Mexican-American actors, Mexican-American personalities, music, games, dances, rhymes, and other elements of Hispanic tradition reflected the bilingual-bicultural environment of the target audience.

Consonant with the aims of the existing bilingual

education programs and classrooms, the primary goal of Carrascolendas was to facilitate the children's knowledge gains in selected first and second grade content areas, and to increase their usage skills in both the English and Spanish languages. Ms. Barrera and her production staff designed materials for each of the 30 half-hour programs to promote learning of specified behavioral objectives in each of the selected content areas. Objectives were provided by a Curriculum Coordinator at the Education Service Center (Region XIII) and approved by an Advisory Committee. The behavioral objectives for the series were developed within six knowledge or content areas. The following capsule descriptions illustrate these areas with different examples in Spanish and English:

1. Self Concept--knowing about one's self, recognizing cultural heritage, and knowing suitable ways to express emotions.

(Examples:)

¿Qué idiomas hablas?

[What language do you speak?]

Name someone, a person or an animal, who needs you to help him.

2. Science--skills such as identifying life cycles of certain animals, knowing processes such as making bread, and being able to identify environmental sights and sounds.

¿Cuál se rompe facilmente?
(piedra, madera, hierro, vidrio)

[Which breaks easily?]
(rock, wood, iron, glass)

Put these pictures in order to show how honey is made.

3. History-Culture--knowing legends, songs, and facts of United States and Mexican history.

¿Cómo se le dice a las cascaras de huevo que tienen confetti?

[What do you call egg shells filled with confetti?]

What are piñatas used for?
(visual - a piñata)

4. Language Skills--knowing certain words in Spanish and English, selected syntactic patterns, and sound contrasts in Spanish and English.

¿Cómo se le dice a la persona que hace pan?

[What do you call the person who makes bread?]

This is a picture of a mouse. In this picture there are two of them. There are two ____.
(visual - 2 mice)

5. Phoneme-Grapheme Relations--knowing relationships between sounds and their corresponding letters, as a skill relevant to reading.

¿Cuál de estas letras es la /k/?
(qu, x, z, r, b)

[Which of these letters is the /k/?]

6. Math--learning certain sets, counting, and symbol recognition.

¿Qué hora es?
(reloj - 3:00)

[What time is it?]
(picture of a clock showing 3:00)

Color one-third of this ball.
(sheet - ball divided into thirds)

Based upon behavioral objectives such as these, each program was comprised of a variety of segments, some running only a few seconds, others up to two or three minutes. Each segment focused on a single behavioral objective. No attempt was made to introduce a particular segment or to have special transition material between segments. However, when segments were combined for a thirty minute program, considerable attention was given to the "flow" from one segment to another, to variety in types of segments, and to the inclusion of logically ordered behavioral objectives. These kinds of segments--with a single objective or two, highly interesting, and often including a "character"--seemed to benefit from the personalized and intense focus offered by the television medium. Evidence of the potential of this approach with young children has also been provided by the success of Sesame Street. Continuity for each program and for the series was provided by setting most of the segments in the imaginary town of Carrascolendas, and by the regular appearance of four or five main characters throughout the series.

In creating the content for Carrascolendas, Ms. Barrera has drawn heavily from her own bilingual and bicultural experiences.

Her strategy has been to create segments in which Spanish is used as it is in everyday life. In a special television segment developed to introduce the program series to teachers, Ms. Barrera commented:

> ...we present Spanish as a language that is natural and acceptable. Because television is essentially a dramatic medium, we rely heavily on dramatic techniques to get our point across....We try to play up the comical aspects and we try to do it in a picaresque fashion. We feel the picaresque is especially appropriate, because the roots of this dramatic form are Spanish-speaking ones.

The picaro was exemplified by one of the most popular regular characters in Carrascolendas, "Agapito" the lion. Other regular characters who appeared in dramatic skits, dance segments, and songs included "Señorita Barrera;" the "Professor;" "Herman," an actor who portrayed a marionette; Spanish and English-speaking hand puppets; and "Cuca," a young Mexican-American girl. In addition to the regular cast, numerous children from the Austin, Texas, area appeared on the programs and prominent Mexican-Americans were featured in cameo roles.

Presentational techniques ranged from elaborate animation and location filming of scenes such as a glassware factory to a single character holding up a sign with a vowel on it. The emphasis in all techniques was on fast pacing and high interest appeal for children. The third year's series was produced in color to take advantage of the appeal of bright, changing colors for young children.

A typical program included the following: A brief segment

in Spanish in which Agapito delightedly pops four balloons, one by one, to illustrate the concept of zero;--a dramatic skit presenting the prepositions "in" and "on" in which the Professor, Herman, Srta. Barrera, and the children ride "in" and "on" large cardboard cutouts of a train, bus, and car;--an animation sequence showing a stork trying to shelter himself from the rain with a very tiny umbrella while the words cigüeña (stork) and paragüitas (umbrella) are repeated;--an English song, "The World Is Round," introduced by a film of a rocket launch; and--a quick dance freeze in which a joke is told in Spanish.

Although Carrascolendas used almost equal amounts of Spanish and English, the Spanish segments were usually shorter than the English ones and often consisted of rhymes, riddles, games, and jokes. Every program began with a song or an animated sequence, which have been found in previous evaluation to be the two most popular aspects of the program. The format for Program 19 in the third year's series provides examples of the duration of each segment, the language used, and the order of the segments (Figure 1).

Like any television script, the script for Carrascolendas includes descriptions of characterization, sets, music, props, and the like. But beyond this, each script contains descriptions of the behavioral objectives for each segment, so that production staff and performers are aware of the educational aims underlying what they are preparing. An example is the script for the

Time	Segment	Language
0:47	1. Intro	
0:30	2. Filler: Dance Freeze #8	Spanish
0:21	3. Math: Disappearing Balloons	Spanish
0:41	4. Animation GÜ /gw/	Spanish
1:44	5. Song: The World Is Round (REPEAT)	English
2:59	6. Film: The Truck	English
0:20	7. Filler: Adult Cameo #1	Spanish
0:19	8. Cameos: Gü /gw/	Spanish
0:30	9. Filler: Dance Freeze #5	Spanish
1:27	10. Song: Stand Everybody Side by Side (REPEAT)	English
3:58	11. Dramatic: The Falling Ball	Spanish
1:01	12. Animation G /g/ (REPEAT)	Spanish
0:30	13. Filler: Dance Freeze #11	Spanish
2:17	14. Puppets: Willy and Gravity	English
1:31	15. Song: Naricita, Naricita	Spanish
0:33	16. Math: Subtracting Lights	Spanish
0:27	17. Filler: Adult Cameo #4--La Navaja (The Knife)	Spanish
1:01	18. Animation GU /g/ (REPEAT)	Spanish
1:18	19. Dramatic: In/On	English
1:44	20. Song: La Vieja Inés (REPEAT)	Spanish
0:14	21. Math: Disappearing Balloons	Spanish
0:30	22. Filler: Dance Freeze #13	Spanish
0:41	23. Animation: Gü /gw/ (REPEAT)	Spanish
2:07	24. Song: B/V Song (REPEAT)	English
0:30	25. Filler: Dance Freeze #9	Spanish
0:20	26. Close	
28:20		

Figure 1. Sample Program Outline

dramatic segment "In/On" of Program 19 shown in Figure 2.

To facilitate classroom use of Carrascolendas, a package of supplementary materials was developed and distributed as a Teacher Guide. The guide contained activities and songs coordinated with television segments of Carrascolendas, as well as additional activities not tied to the program. The guide was deemed necessary to encourage teachers to provide children with "doing" as well as "viewing" experiences. Because the television presentation could not always include all facets of each behavioral objective, the guide offered an expansion of concepts and ideas. This made it possible for the teacher to encourage supplementary classroom activities, which would have been difficult to illustrate in the series.

For the monolingual English-speaking teachers, the Teacher Guide provided insight into the Mexican-American culture. It helped the teacher see the rationale behind the behavioral objectives. In this way it was hoped that Carrascolendas activities would become closely tied and pertinent to the regular classroom curriculum.

For instance, the Teacher Guide description of the "In/On" segment of Program 19 includes an explanation of the difficulty Spanish speakers have with these English prepositions (Figure 3). Suggestions for songs, games, and other activities were also included in the guide. While fulfilling the essential behavioral objective criterion, each activity included in the guide was

Program 19

Segment In/On

OBJECTIVE: The child can comprehend and produce English statements using "on" indicating position of contact with an upper surface (e.g. on the chairs, tables, floor) and indicating position of being inside certain vehicles (e.g. on the train, bus, plane). Child can comprehend and produce an English statement of position of being inside a car (e.g. in the car).

Language: English

Setting: Multilevel

Characters: 2 clowns, The Professor, Pirulín, Agapito, Srta. Barrera, Children, Sr. Villarreal

Visuals: Keys of on, in

Props: Cutouts of train, bus, car; Easy chair; Storybook; Building blocks

Costumes: Characters' outfits

Music: Arranger's choice

(NOTE: We need sound effects for train leaving, bus leaving, car leaving.)

(Two clowns push in cutout train. Stop and hold two sides of it. They face front. Pirulín and children scramble to get on it. Loudspeaker says: All aboard, please. All aboard. There's a pause after they get settled. Pirulín speaks)

Pirulín: We're on the train. We're on the train.

Children: We're on the train. We're on the train.

Key: On (flashes)

(Sound effect of train leaving. Clowns push train out. Pirulín and children scramble behind it...waving good-bye.)

(Easy chair propped anywhere. Srta. Barrera sits surrounded by children, who are on the chair. She reads them storybook. She reads, interrupts herself...)

Srta. B: We're on the chair. We're on the chair.

Children: We're on the chair. We're on the chair.

Key: On (flashes)

(Two clowns push in cutout of bus. Stop and hold two sides of it. They face front. Agapito and children scramble to get on it. Loudspeaker says: The bus is leaving. The bus is leaving. There's a pause after they get settled. Agapito speaks)

Agapito: We're on the bus. We're on the bus.

Children: We're on the bus. We're on the bus.

Key: On (flashes)

(Sound effect of bus leaving. Clowns push bus out. Agapito and children scramble behind it...waving good-bye.)

(Sr. Villarreal with children on the floor. They are playing with building blocks or some such. He gestures to them, interrupts himself...)

Sr. V: We're on the floor. We're on the floor.

Children: We're on the floor. We're on the floor.

Key: On (flashes)

(Resumes pose of gesturing to children)

(Two clowns push in cutout of car. Stop and hold two sides of it. They face front. The Professor and children scramble to get on it. The Professor says: Come on...We're going for a ride. We're going for a ride. There's a pause after they get settled. The Professor speaks)

The P: We're in the car. We're in the car.

Children: We're in the car. We're in the car.

Key: In (flashes)

(Sound effect of car leaving, sputtering jerkily...clowns will move the car back and forth to the time of the jerks...car continues to sputter...dies. The Professor starts to wave...stops, comes out to front of car...raises hood--hopefully, we can see smoke coming out or some such--maybe clown can get back there and plant smoke bomb...the Professor turns to the audience)

The P: Well, I guess we didn't go for a ride after all.

Figure 2. Sample Script of Carrascolendas Segment

ENGLISH LANGUAGE SKILLS - In and On

This segment shows children on a bus, on a train, on the floor, on a chair, and in a car.

Uses of "on" in English are difficult for Spanish speakers who generalize, "If I can say 'on a bus,' 'on a bicycle,' 'on a train,' I can say 'on a car.'" This last expression would have a very different meaning from "in the car" which is what a native speaker of English would say.

Figure 3. Teacher Guide Description of In/On Segment of Program 19

chosen with a view to intrinsic interest, stimulation, humor, and fun for the children.

An evaluation of usage of the Teacher Guide indicated that teachers were generally pleased with the guide and were incorporating its use into their classroom curriculum.

Selection of Test Sites and Subjects

The subjects for this study were selected from among Mexican-American children in grades kindergarten through second who participated in the 1972-73 national evaluation of the bilingual educational television program Carrascolendas. In the national evaluation eleven test sites in eight cities were chosen as representative of different types of Mexican-American populations across the nation.

Test Sites

Test cities and sites were chosen by the Carrascolendas evaluation team in cooperation with the Education Service Center, Region XIII, and were as follows:

Albuquerque, New Mexico

Edinburg, Texas

Lansing, Michigan

Los Angeles, California

Pueblo, Colorado

San Antonio, Texas

Tracy, California

Tucson, Arizona.

Although data from subjects in Pueblo, Colorado, were included in the national evaluation, these data were not included in the present study because the information necessary to match classroom and student data was not provided by the Pueblo field consultant.

Two test sites were chosen in each of the most populous states in terms of Mexican-American communities, California and Texas, to obtain results from both urban and rural areas. The Michigan site represented children of migrant families. Further, Albuquerque and San Antonio each had two test sites to obtain results from children involved in a bilingual classroom curriculum and children involved in a monolingual (English) curriculum. Most sites had bilingual programs which were funded by Title VII. Those schools not having bilingual programs were located in Lansing and Tracy.

The average school enrollment at test sites was 556, with the smallest school in Lansing (215), and the largest in San Antonio (972). All sites with the exception of Lansing and Tracy had an enrollment of 75% or more Mexican-American children. At Lansing, the average enrollment of Mexican-American children was 30% and at Tracy it was 24%. Of the 13 test site schools involved in the evaluation, the approximate annual income of families in 10 was $1,000-4,999. The remaining three schools, located in Lansing and Tracy, had approximate annual family incomes of $5,000-9,999. Time of viewing Carrascolendas varied among the sites, with most children viewing the series between 9:00 a.m. and 12:30

p.m. In Albuquerque, with an air time of 2:30 p.m., teachers indicated displeasure with afternoon viewing of the series. Classes in San Antonio and Tucson were the only ones who viewed Carrascolendas in color; all others viewed the series in black and white.

Subjects

Mexican-American children in kindergarten, first and second grades at each of the eleven test sites were selected for participation in the Carrascolendas national evaluation. As stated above, however, children at the two test sites in Pueblo, Colorado, were not included in the present study. Field consultants attempted to select subjects randomly from among children in classes viewing or not viewing Carrascolendas. The number of classes not viewing the series, however, was limited and nonviewer subjects in each grade at each test site tended to come from a single class. At each test site 15 viewers and 5 nonviewers in each grade were originally pretested. Posttests were to be completed with 12 viewer and 4 nonviewer subjects from every grade level to allow for illness and/or transfers from the school. The final numbers of subjects who completed the test sequence is given for each site and grade level in Table 6. A total of 405 subjects completed testing in Spanish, with 406 subjects completing testing in English. As can be seen in Table 6, nearly equal numbers of viewers completed testing in each grade level at each site. Similarly, nearly equal numbers of nonviewers completed

Table 6

Numbers of Subjects by Site and Grade Level

Site	Viewers			Nonviewers		
	K	1st	2nd	K	1st	2nd
Albuquerque, NM[a]	12[c]	12	12	4	4	3
Albuquerque, NM[b]	12	12	12	4	4	4
Edinburg, TX	12	12	12	4	4	4
Lansing, MI	10	5	11[d]	3	0	4
Los Angeles, CA	13[c]	15	13	5	4	5
San Antonio, TX[a]	12	12	12	5[d]	5[c]	3
San Antonio, TX[b]	12	12	12	0	0	0
Tracy, CA	11	11	12	4	4	4
Tucson, AZ	11	12	11	4	4	4
Grade Subtotals:	105	103	107	33	29	31
Viewer/Nonviewer Subtotals		315			93	
Total Subjects			408			

Total subjects who completed testing in Spanish: 405

Total subjects who completed testing in English: 406

[a]Site with bilingual curriculum
[b]Site with monolingual (English) curriculum
[c]One subject in this group did not complete testing in Spanish.
[d]One subject in this group did not complete testing in English.

testing in each grade level at each site, with the exception of one of the sites in San Antonio. At this site nonviewers in monolingual (English) curriculum classrooms could not be obtained.

Data Collection

Measures of the variables of interest in the present study were collected with a variety of instruments as follows:

(1) Pre and postseries criterion referenced tests provided measures of learning effects resulting from viewing the Carrascolendas series;

(2) Reports prepared by teachers of children who participated in the study provided measures of:

   (a) Individual viewer characteristics;

   (b) Contextual variables; and,

   (c) Characteristics of communication stimuli.

Data collection in each test city was coordinated by a field consultant. The consultants were recruited and trained during the summer (1972) prior to broadcast of the series. Consultants met with the evaluation team during the second week in August, 1972, to review the evaluation activities. They viewed a sample program of Carrascolendas and were supplied with sample instruments as well as detailed procedures for hiring testers and for instructing testers in interview and scoring techniques. During the evaluation experiment, members of the evaluation team were available to all field consultants upon request.

In addition to coordinating testing of the children participating in the experiment and providing information regarding the test site, field consultants obtained absence reports for children participating in the experiment and distributed other instruments for completion by the teachers. The various instruments used to collect data for the present study are described in further detail below.

Criterion Referenced Tests

The learning effects of the Carrascolendas program series were assessed in terms of preseries and postseries measurements. These measurements were taken on criterion referenced tests, where test items were developed from samplings of the instructional objectives of Carrascolendas. The curriculum staff for the Education Service Center, Region XIII, prepared the original set of objectives which was presented to the production staff for incorporation in the series. The evaluation team sampled from among those objectives presented in the series and developed test questions on the sampled objectives. Two tests were developed, one in Spanish the other in English, and each test was administered in an oral interview by a tester fluent in the test language. The details of test instrument construction and administration are discussed below.

Instrument development. The criterion referenced instruments were based upon behavioral objectives specified prior to program production. A total of 357 objectives were specified in

several content areas by the Education Service Center staff. Of these, the production staff incorporated 269 objectives in the series and the test instruments tested 103 of these. Table 7 illustrates the relative breakdown of objectives into content areas both by number and by time allotted in the program series to objectives presented. Of the content areas, Phoneme/Grapheme, Spanish Language Skills, and Math were treated exclusively in Spanish, with English Language Skills treated exclusively in English. History/Culture, Self Concept, and Science were treated in both Spanish and English. While most objectives were treated in one language only, some objectives were treated twice, once in Spanish and once in English. Both the English and the Spanish versions of the test instruments, however, were designed to correspond with objectives treated only in Spanish or only in English. A total of 71 objectives was tested in Spanish and 32 objectives were tested in English.

The development of individual test items is best illustrated by a specific example. For instance, one of the objectives of the series was that after being exposed to a story about a celebration, the child would be able to identify related pictures taken directly from the program, such as a picture of a piñata. This objective was tested in the English test with two questions: (1) What is this? (The child is shown a picture of a piñata.) (2) What are piñatas used for?

The Spanish test instrument consisted of 56 items, while

Table 7

Comparison of Objectives Presented and Tested in the Series

Content Areas	Number of Objectives Presented by the Curriculum Staff	Number of Objectives Incorporated in the Series by the Production Staff				Number of Objectives Tested		Time Allotted in Series to Objectives Presented		Time Allotted in Series to Tested Objectives	
		Spanish	English	Extra	Total	Spanish	English	Spanish	English	Spanish	English
History Culture	27	9	5		14	7	5	2:20:44	28:58	1:09:59	21:36
Self Concept	27	3	14	6	23	5	6	17:59	59:22	17:59	9:02
Science	59	5	27	11	43	4	10	20:59	2:03:48	14:11	49:59
Spanish	48	12			12	10		40:52		24:19	
English	42		32		32		11		3:28:12		1:30:36
Math	37	28			28	9		43:57		18:10	
Phoneme Grapheme	117	117			117	36		2:43:53		59:41	
Totals	357	174	78	17	269	71	32	7:08:24	7:00:20	3:24:19	2:51:03

the English test consisted of 44 items. The same questions were used on pretests and posttests, but the questions were reordered for posttest administration. These instruments were revisions of instruments used in the previous regional evaluation of Carrasco-lendas conducted in 1971-72. As a result of revision, 37 items on the English test were retained from the previous year, with 36 items being retained on the Spanish test instrument. The tests used in the national evaluation (1972-73) were analyzed to determine the reliability of the entire test, as well as the reliability of the subtests for each content area on both the Spanish and the English test instruments. One useful measure of the consistency of a test is the alpha coefficient of reliability. This coefficient, which can range from 0 to 1.0, gives an estimate of such qualities of the test as whether the test differentiates high scorers clearly from low scorers and whether the test is internally consistent. Alpha coefficients of reliability were computed for the total test and for the content area subtests and are displayed in Table 8. As can be seen from Table 8, the reliability of the entire test was high on both pre and post administration of both the English and Spanish tests. Reliability coefficients of the content area subtests, as expected due to reduced test lengths, ranged from a low of .51 to a high of .91.

Administration and scoring procedures. Pretesting at most test sites was completed prior to initial viewing of the series. In Lansing, however, pretesting was not completed until

Table 8

Alpha Coefficients of Reliability

of Criterion Referenced Test Instruments

	Self Concept	History Culture	Language Skills	Science	Phoneme Grapheme	Math	Total
			Spanish				
Number of items	5	8	14	4	13	12	56
Pre	.81	.91	.68	.53	.87	.90	.96
Post	.80	.89	.81	.51	.85	.87	.96
			English				
Number of items	6	6	16	16			44
Pre	.63	.80	.51	.84			.90
Post	.66	.83	.55	.86			.92

after the first three programs in the series had been shown. Some children at the Lansing site, therefore, may have viewed one or two programs before they received pretests. All posttesting was completed prior to the December holidays in order to eliminate the potential contamination of effects due to differential retention of material learned. Posttesting was begun at some sites prior to airing of the last program in the series. Although some children may not have seen the last few programs in the series prior to receiving the posttest, only objectives presented in the first 27 programs were tested. Thus, very few if any children were tested on objectives from a program they had not seen.

Children at all sites were tested individually in Spanish and English with three or more days elapsing between administration of the tests in each language. The tests were administered in oral interviews by individuals who were fluent in the test language and had been trained by field consultants in the interview techniques to be used. It was recommended that all testers spend time in the classrooms prior to testing and that they conduct two or three sample interviews with children who were not subjects in the evaluation experiment. According to reports from testers these procedures were followed.

While conducting the test interviews, the tester met with the child outside his regular classroom. In most schools tests were administered in relatively private areas. Efforts were made

throughout the interview to maintain a relaxed atmosphere, with all remarks addressed to the child in the language in which the test was being conducted.

Each question was read aloud to the child and any necessary visual materials were presented by the testers. The child's response was scored by the tester on the test instrument. A format of the test instrument is illustrated by the first page of the English and the Spanish tests presented in Appendix A.

Responses to test items were scored in two ways: content and language usage. Content scores were differentiated as follows: a perfect response (weighted as a "4"), a prompted response (weighted as a "3"), a partial response (weighted as a "2"), and an incorrect or no response (weighted as a "1"). Language usage scores were not considered in the analysis in the present study.

The test instruments were designed with numeric scores for content and language on each item (Appendix A). The interviewer circled the number which defined the child's response. These numbers were then coded to provide data for computation of individual scores.

In order to determine the accuracy of scoring among test interviewers an instrument was developed to measure the reliability of scoring. An Interviewer Reliability Form consisting of six test questions was sent to each tester (Appendix B). Each question also gave a hypothetical child's response. The interviewer was required to mark the score he/she would give the child

on each test question. This instrument did not require the identification of the interviewer in hopes that the form would be completed without distortion. Forms were identified by site, however, by checking postmarks (whenever possible) upon receipt.

The results provided evidence of generally reliable uniformity among sites. Two Spanish field agents in Albuquerque scored at least half of the items wrong, however, making results from that site somewhat questionable. The Edinburg, Lansing, and San Antonio sites each had two responses marked wrong. A few responses were received which could not be identified according to site due to missing postmarks.

Evaluators reviewed all instruments prior to coding, and those items requiring the child to respond by marking on the test instrument were checked against scored results; adjustments were made if necessary.

Dependent variables. Each child had a variety of scores which represented his responses in the Spanish and English interviews. The child's average response on an entire test represents an overall measure of learning effects which resulted from viewing the whole program series. Accordingly, a total average score was computed for each child from his responses to all items on a particular test. This score is a complex measure however, since several content areas were treated in the program. The process of computing a total average score vitiates the differences in the impacts of the several content areas included in the total

average. In order to see the effects in each of the content areas, subtest scores were also computed using the child's responses to items pertaining to a particular content area. The following scores were computed for each child's responses to the Spanish and English pre and posttests:

(1) total average score; the average score on a one-to-four scale on all items on a particular test.

(2) Self Concept score; the average score on items pertaining to the content area of Self Concept.

(3) History/Culture score; the average score on items pertaining to the content area of History/Culture.

(4) Language Skill items; the average score on items pertaining to the content area of Language Skills.

(5) Science; the average score on items pertaining to the content area of Science.

Two additional scores were also computed for the Spanish interview test on content areas which were treated only in Spanish:

(6) Phoneme/Grapheme score; the average content score of items pertaining to the content area of Phoneme/Grapheme Relations.

(7) Math score; the average content score of items pertaining to the content area of Math.

Site and Teacher Reports

As noted above, the independent variables of interest in

this study were characteristics of the communication stimuli, individual viewer characteristics, and contextual characteristics. The only information collected on individual viewers was the grade level and the sex of each subject. This information was obtained from the test interviewers. Teachers of children who participated in the Carrascolendas national evaluation provided information regarding their own backgrounds, classroom activities, student absences, and communication stimuli. Information about communication stimuli included the number of Carrascolendas programs viewed by each subject and whether the programs were viewed in color or black and white. In addition, information was obtained as to whether the subject also viewed Sesame Street and/or any other educational television programs. Information regarding the viewing of other educational television programs was sought because it provides a perspective on Carrascolendas viewing. If the subject, for example, viewed no other educational television programs, then for that subject viewing of Carrascolendas was a somewhat isolated instance of instructional stimulation through educational television. On the other hand, if the subject viewed other educational television programs, then viewing of Carrascolendas could be considered less a novel event and more a practice of some familiarity to the student. Viewership of Sesame Street was isolated as an independent variable for two reasons--first, the 1972-73 Sesame Street programs were targeted in part at an audience of Mexican-American children; and, second, although Sesame

Street was targeted at a younger audience than the Carrascolendas audience, a number of teachers reported that subjects participating in the Carrascolendas experiment also viewed Sesame Street as a regular part of their classroom activity. Information about contextual variables included measures of the teacher's background and fluency in Spanish, the presence and Spanish fluency of a teacher aide, the amount of bilingual instruction conducted in the classroom, whether supplementary activities related to Carrascolendas were conducted in Spanish or English, and the number of children and ethnic composition of the class. Instruments used to collect information on these independent variables are discussed in further detail below.

Site reports. Field consultants were asked to provide a Site Status Report between the times pretesting was completed and posttesting was begun. A copy of the form used for these reports is contained in Appendix A. The information from item 7 regarding the broadcast dates of individual Carrascolendas programs was used in comparison with absence reports (Appendix A) provided by classroom teachers in order to determine the actual number of programs viewed by each subject.

Absence reports. After the broadcast of the Carrascolendas series had been completed for the fall semester, each teacher of students who participated in the national evaluation was given a form listing the names of viewer or nonviewer students in her class (Appendix A). Field consultants distributed these forms to the teachers and requested that the teachers list all of the

dates that each student was absent during the semester. As stated above, these dates were then compared with program broadcast dates in order to determine the number of programs actually viewed by each student.

Classroom information reports. Classroom information was obtained on a form completed by each teacher and illustrated by the examples in Appendix A. Two sets of classroom information forms were used: one for teachers of nonviewer students and one for teachers of viewer students. On the nonviewer classroom information form, the teacher reported her fluency in Spanish, her academic degrees, and the number of years she had taught school. The teacher also reported the amount of bilingual instruction given to her class and whether or not the class participated in any televised instruction. The teachers response to the question, "Do you speak Spanish?" was coded as follows: English only was coded as a 0; limitedly as a 1; moderately as a 2; and, fluently as a 3. Whether the teacher had a bachelor's degree and a master's degree were both coded as binary variables , weighted as a 1 if the teacher had the degree and 0 if not. Years of teaching experience was coded directly as a continuous measure. The amount of bilingual instruction was recorded as three measures, weekly frequency of bilingual instruction, for example, was weighted as a 5 for daily instruction to a 1 for instruction once a week. The number of hours per day of bilingual instruction was coded as a continuous measure. The number of hours per week of

bilingual instruction was also computed by multiplying frequency times hours per day. This computation provides a kind of lump sum measure of bilingual instruction. Participation in televised instruction was an open-ended question on the form. In coding responses, mentions of Sesame Street were coded as a 1 in a binary variable, and the number of educational television programs mentioned, other than Carrascolendas, was recorded as a continuous variable. The number of children in the class, also reported on this form, was recorded as a continuous measure.

In addition to the information requested of teachers in nonviewer classrooms, teachers of viewer students reported whether they initiated supplementary activities related to Carrascolendas before or after the program, and whether the activities were conducted in Spanish or English. Supplementary activities and the language of activities were recorded as binary measures, i.e., if supplementary activities were conducted a 1 was scored, 0 otherwise. Two measures were used to code the language of activities, one for Spanish and one for English. The coding was accomplished as follows:

	Spanish	English
Mainly Spanish	1	0
Mainly English	0	1
Half Spanish/Half English	1	1
No activities	0	0

Teacher Diary. Most of the teachers of viewer students

maintained a program-by-program "diary" of comments and rating scales evaluating each program in the series. The first page of the Teacher Diary was a form requesting general information (Appendix A). Data regarding the presence in the classroom of a teacher aide and whether the aide spoke Spanish were recorded in binary form, 1 if yes and 0 if no. The ethnic composition of the class was also reported on the general information form. The percentage of Mexican-American students in the class was recorded for use in the present study as a continuous variable ranging from 1 to 100.

Independent variables. Data collection during the course of the national contract evaluation of Carrascolendas yielded the following measures of independent variables available for analysis in the present study:

(1) Pretest scores which were measures of the knowledge levels of the subject prior to viewing any of the program series.

(2) Measures of communication stimuli, including frequency of viewing of the Carrascolendas program series; whether the program was viewed in color or not; viewing of Sesame Street; and, viewing of other educational television programs.

(3) Measures of individual characteristics, including grade level and sex.

(4) Measures of contextual characteristics, including measures of supplementary activities (in Spanish and in English); measures of the amount of bilingual instruction given the

subjects in terms of frequency, hours per day, and hours per week; measures of the background(s) of the teaching staff, including whether the teacher had a bachelor's degree and a master's degree, the teacher's experience and Spanish fluency, whether a teacher aide was present in the subject's class, and whether the aide spoke Spanish; and, the number of children and percentage of Mexican-American children in the subject's class.

Chapter III

Analysis and Results

Overview

The primary goal in this study was the development of a mathematical model for the prediction of learning effects of a bilingual children's educational television program series. As discussed in Chapter Two, the program material consisted of the Carrascolendas educational television series. Learning effects were defined as scores on criterion referenced tests administered after broadcast of the entire program series. Independent variables included measures of viewership of the program series, other communication stimuli, individual receiver characteristics, and contextual characteristics.

The statistical technique of linear multiple regression analysis was utilized for the construction of a predictive mathematical model. The strategy for constructing an optimum model was as follows:

(1) Dependent and independent variables were selected and measures were defined in terms of multiple regression notation.

(2) The subject pool was divided into two equal samples. One of these samples was used in prevalidation construction of the model. The remaining sample was used in cross-validation of

the model.

(3) Independent variables which consisted of continuous measures were tested to determine whether they had a significant curvilinear relationship with the dependent variable in a particular model.

(4) A starting model was constructed for each dependent variable. This model included all potential independent variables, along with curvilinear expressions where appropriate.

(5) The starting model was constructed using an iterative procedure. This procedure yielded estimates of the error mean square at each step in the construction of the model. The estimates of the error mean square were visually inspected to determine which independent variables contributed least to the prediction equation. These variables were initially eliminated as the next step toward the construction of an optimum model.

(6) A series of restricted models was constructed by successively eliminating remaining independent predictor variables which contributed least to the prediction equation at each step.

(7) These restricted models were applied to the cross-validation sample to determine which model provided optimum predictive efficiency.

The details of the analysis and results are presented in order below.

Selection and Definition of Variables

Dependent Variables

The dependent variables available for analysis in this study consisted of total average scores on criterion referenced tests administered in Spanish and in English, and subtest scores on content areas. Since the present study aimed at predicting learning effects resulting from viewing the Carrascolendas program series, dependent variables which were reliably and consistently related to program viewing were chosen for analysis. The selection of such dependent variables thus permitted investigation of the correlates of program viewing in the attainment of learning effects.

Table 9 presents the correlations of the viewing measure with posttest scores for the total tests and the content area subtests in both Spanish and English. As can be seen in the table, the Spanish subtest of History/Culture and the English subtest of Science were the only test scores significantly correlated with the measure of viewership of the program series, with Spanish History/Culture scores exhibiting the strongest correlation. The English subtest of Language Skills and the English Total test scores also approached significant correlation with the viewing measure (a correlation of .1380 was required). As pointed out in Chapter Two, the content area subtests represent less ambiguous measures than the total test, since the total test score was computed by averaging across items from all content

Table 9

Correlations of Viewing Scores and Posttest Scores

Name of Posttest	Correlation with Viewing Measure
Spanish	
Self Concept	-.0349
Language Skills	.0135
History/Culture	.1939*
Science	-.0038
Phoneme/Grapheme	.0893
Math	.0475
Total	.0597
English	
Self Concept	.0076
Language Skills	.1220
History/Culture	.1132
Science	.1487*
Total	.1291

*p<.05

areas. The English Total test score, therefore, was eliminated from consideration as a dependent variable in the present study.

The results of the national contract evaluation analyses were presented and discussed in Chapter One (Tables 4 & 5). These analyses indicated that significant viewer-nonviewer differences were found most consistently in Spanish testing of the History/Culture concept area and next in English testing of Language Skills. Significant results were indicated for kindergarten and combined grades in English testing of Science. The reliability of the English subtest of Language Skills, however, was among the lowest for any content area, whereas the reliabilities for the other two subtests were quite high, with the Spanish History/Culture subtest the highest of any content area (see Table 8, Chapter Two).

Since the Spanish History/Culture subtest was the subtest which was most reliably and consistently associated with program viewing, this measure was chosen as the primary dependent variable of interest for the construction of a predictive model. Based upon its high reliability and significant correlation with the viewing measure, the English Science subtest was also chosen as a dependent variable for the construction of a model to provide comparison and contrast with the model constructed for the prediction of Spanish History/Culture scores.

In the notation of multiple regression analysis, the dependent variable will hereafter be referred to as the criterion

variable. Since one criterion variable is dealt with at a time in multiple regression analysis, separate models were constructed using Spanish History/Culture posttest scores and English Science posttest scores as criterion variables.

Independent Variables

The independent variables available for analysis in this study included measures of communication stimuli, individual characteristics, and contextual characteristics. The collection of data on these variables is discussed in detail in Chapter Two and will not be repeated here. Nineteen independent variables were available for use in the present study.[1] Because a subject's posttest score depends to a certain extent upon his pretest score, the pretest scores in Spanish History/Culture or English Science were added to the independent variable set for the respective models predicting posttest scores.

In the notation of multiple regression analysis, measures of the independent variables will be referred to as predictors, and the pool of subjects' scores on a particular variable is referred to as a vector. For example, the list of all subjects' scores on the Spanish History/Culture posttest is a criterion vector for one of the models constructed in this study. The

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[1]The measure of whether the subject's teacher had a bachelor's degree provided no differentiation among subjects nor predictive power, since all of the teachers had a bachelor's degree.

corresponding scores of those subjects on the measure of viewership of the Carrascolendas program series is one of the predictor vectors in a predictor set.

The criterion and predictor vector sets are summarily listed and defined in Table 10.

Division of the Subject Pool

The subject pool (408 subjects) was divided into two equal samples, so that models constructed with one sample could be cross-validated with data from the other sample. The division was accomplished by selecting every other subject from each test site for inclusion in one sample, with the remaining subjects included in the other sample. In the following discussion, the sample used for original construction of models is referred to as the prevalidation sample. The other sample is referred to as the cross-validation sample.

Spanish History/Culture Model Construction

Although the procedures used for the model construction were the same for both criterion vectors, construction of models for each will be discussed separately in order to avoid confusion of the results of statistical tests conducted at different steps in model construction.

Linearity Tests

The relationship of a predictor variable with the criterion

Table 10

Variable Set

Name	Definition
	Criterion
Posttest	A vector containing the posttest scores of the subjects.
	Predictors
Unit	A "unit vector" all of whose elements are 1.
Pretest	A continuous vector containing the pretest scores of the subjects.
Viewing frequency	A continuous vector containing the number of Carrascolendas programs viewed by the subject (ranges from 0 to 27).
Color TV	A binary vector containing a 1 if the program was viewed in color, 0 otherwise.
Sesame Street	A binary vector containing a 1 if the subject viewed Sesame Street, 0 otherwise.
Educational TV	A continuous vector containing the number of educational television programs, other than Carrascolendas, viewed by the subject.
Grade	A continuous vector containing the subject's grade level.
Sex	A binary vector containing a 1 if the subject is female, 0 otherwise.
Activities (any)	A binary vector containing a 1 if the subject was given supplementary activities, 0 otherwise

Table 10 (continued)

Name	Definition
	Predictors (continued)
Activities (Span.)	A binary vector containing a 1 if supplementary activities were conducted in Spanish, 0 otherwise.
Activities (Eng.)	A binary vector containing a 1 if supplementary activities were conducted in English, 0 otherwise.
Bilingual instruction (days)	A continuous vector containing the number of days per week in which the subject's class was given bilingual instruction.
Bilingual instruction (hours/day)	A continuous vector containing the number of hours per day during which bilingual instruction was conducted.
Bilingual instruction (hours/week)	A continuous vector containing the number of hours per week during which bilingual instruction was conducted.
Teacher MA	A binary vector containing a 1 if the subject's teacher holds a master's degree, 0 otherwise.
Teacher experience	A continuous vector containing the number of years teaching experience of the subject's teacher.
Teacher Spanish	A continuous vector containing the rating of the teacher's fluency in Spanish.
Aide	A binary vector containing a 1 if a teacher aide was used in the subject's class, 0 otherwise.

Table 10 (continued)

Name	Definition
Predictors (continued)	
Aide Spanish	A binary vector containing a 1 if the teacher aide speaks Spanish, 0 otherwise.
Mexican-American percentage	A continuous vector containing the percentage of Mexican-American children in the subject's class.
Class size	A continuous vector containing the number of children in the subject's class.
Vectors Included for Linearity Tests	
Pretest squared	A continuous vector containing the square of the pretest scores of the subjects.
Viewing frequency squared	A continuous vector containing the square of the number of Carrascolendas programs viewed by the subject (ranges from 0 to 30).
Educational TV squared	A continuous vector containing the square of the number of educational television programs, other than Carrascolendas, viewed by the subject.
Grade squared	A continuous vector containing the square of the subject's grade level.
Bilingual instruction (days) squared	A continuous vector containing the square of the number of days per week in which the subject's class was given bilingual instruction.

Table 10 (continued)

Name	Definition
Vectors Included for Linearity Tests (continued)	
Bilingual instruction (hours/day) squared	A continuous vector containing the square of the number of hours per day during which bilingual instruction was conducted.
Bilingual instruction (hours/week) squared	A continuous vector containing the square of the number of hours per week during which bilingual instruction was conducted.
Teacher experience squared	A continuous vector containing the square of the number of years teaching experience of the subject's teacher.
Teacher Spanish squared	A continuous vector containing the square of the rating of the teacher's fluency in Spanish.
Mexican-American percentage squared	A continuous vector containing the square of the percentage of Mexican-American children in the subject's class.
Class size squared	A continuous vector containing the square of the number of children in the subject's class.

variable may be more complex than a simple linear relationship. For example, an increase of one unit on the measure of program viewing might be associated with an increase of one unit on the criterion of posttest score. This would be a simple linear relationship. The equation for expressing a simple linear relationship is: $Y = a_oU + a_1X + E$ (1)

In this equation Y represents the criterion vector of posttest scores; X represents the predictor vector, i.e., number of programs viewed; E represents a vector of error terms, that is the difference in the predicted posttest score and the observed score; and, a_1 is a numerical constant or weight applied to X. The regression constant, i.e., the Y intercept, is represented by the weighting constant a_o applied to U, a unit vector, i.e., a vector containing a "1" in every element.

If, however, the relationship between posttest scores and the viewing measure is curvilinear then an increase of one unit of viewing would not, in general, be associated with an increase of one unit on the posttest. In the case of a curvilinear relationship, the equation would include a term which represented the square of the predictor variable, as: $Y = a_oU + a_1X + b\ (X*X) + E$ (2)

In model 2 the square of the predictor variable is indicated by (X*X), which follows computer notation using an "*" to indicate multiplication. The relationship of predictor variables with the criterion variable may be tested to determine whether a simple linear relationship provides adequate prediction, or whether a curvilinear relationship is significantly more

appropriate. Linearity tests were conducted for all of the continuous variables in the predictor set in the following manner. Two models in the form of models 1 and 2 above were constructed using each continuous variable in turn to predict posttest scores. For example, pretest scores were used to predict posttest scores in the following models:

$$\text{Posttest} = (a_1)\text{Pretest} + (a_2)(\text{Pretest}*\text{Pretest}) + \text{Error} \quad (3)$$

$$\text{Posttest} = (b_1)\text{Pretest} + \text{Error} \quad (4)$$

If the curvilinear model (3) describes the data relationships more effectively than the straight line model (4), an F-ratio comparing the two models gives an indication of this difference. F-ratios comparing models of these forms, therefore, were calculated for all continuous variables. Where significant F-ratios were obtained, the square of the predictor was also included in the starting model or equation for predicting the posttest scores. The results of these tests are presented in Table 11.

As shown in Table 11, the curvilinear form of the equation was significantly different from the linear or straight line form for five predictor variables when Spanish History/Culture posttest scores were used as the criterion. The starting model for the prediction of Spanish History/Culture scores, therefore, included the squared terms for these five variables.

It should be noted that higher order curvilinear relationships, such as cubic, and interaction among predictor variables might also have been tested. The inclusion of such complex

Table 11

F-tests for Curvilinearity in

Spanish History/Culture Predictors

Variable Name	RSQ Curvilinear Form	RSQ Straight Line Form	F-ratio
Pretest	.4502	.4463	1.43
Viewing frequency	.0376	.0376	.01
Educational TV	.0015	.0004	.23
Grade	.0775	.0727	1.03
Bilingual instruction (days)	.2118	.2087	.79
Bilingual instruction (hours/day)	.1702	.1394	7.46*
Bilingual instruction (hours/week)	.1453	.1286	3.91*
Teacher experience	.0381	.0193	3.93*
Teacher Spanish	.0511	.0500	.22
Mexican-American percentage	.1320	.0849	10.90*
Class size	.0397	.0003	8.25*

* $p<.05$

variables might have provided a better "fit" of the equation to the data of the prevalidation sample. This increase in fitting the equation to the data would also have increased the sensitivity of the equation to the peculiarities and idiosyncrasies of the prevalidation sample. In the present study, a more generalizable model was sought which would have high efficiency in cross-validation. Ward (1953) has shown that the inclusion of complex variables in equations constructed with data from the prevalidation sample tends to result in greater loss of predictive efficiency on cross-validation than the use of noncomplex variables. Higher order relationships and interactions, therefore, were not examined in the present study.

Model Construction

All phases of model construction in this study were accomplished using linear multiple regression analysis. The analysis procedure was essentially one of model-seeking. A starting model incorporating all potential predictors including curvilinear expressions where appropriate, was calculated with a computer program which used an iterative process (Ward & Jennings, 1973, p. 317). Such a process begins by setting all predictor weights at 0, and then adjusting the weight on one predictor at a time until some arbitrary criterion is met to stop the iteration process. In this study the stop-criterion was that the increase in the square of the multiple correlation coefficient (RSQ) had to be equal to or greater than .0001. The value of RSQ gives an

indication of the proportion of variance in the criterion measure which is being accounted for by the predictors in the model. The computer program begins by selecting the predictor variable which yields the greatest RSQ, and then adding a new variable from the predictor set or adjusting the weight of a predictor already in the equation at each step in the iteration process. Table 12 presents the first 30 iterations in the computation of the equation for the starting model. Below the iteration sequence final values are reported for RSQ, the error sum of squares, the error mean square, and the standard error of the estimate. Inspection of the results calculated at each iteration step can serve as a rough guide to the way the model changes with the introduction of each new predictor variable. The error mean square is of particular interest, since this statistic gives an indication of the predictive accuracy of a model.

Next, in Table 13, all of the variables in the predictor set of the starting model are listed along with their raw weights, standardized weights, and correlation with the criterion vector. The column headed "Entry" is the order in which the predictors entered the equation during the iterative process. In general, the order in which predictors entered the equation is highly correlated with the rank-order of measures of the "relative contribution" of each predictor to the prediction of the criterion (Ward & Jennings, 1973, p. 271). In the present study the entry order of predictors was used as a guide in the construction of

Table 12

Spanish History/Culture Iteration Sequence for Starting Model

Variable	RSQ	Error Sum of Squares	Error Mean Square	Standard Error of Estimate	Iteration
Pretest	.44632	79.44	.3933	.6271	1
Bilingual instruction (days)	.51782	69.18	.3442	.5867	2
Viewing frequency	.54064	65.91	.3295	.5740	3
Teacher MA	.55823	63.38	.3185	.5644	4
Activities (English)	.56666	62.17	.3140	.5604	5
Viewing frequency	.57314	61.24	.3093	.5562	6
Aide	.57953	60.33	.3062	.5534	7
Bilingual instruction (hours/day)	.58636	59.35	.3028	.5503	8
Bilingual instruction (days)	.59148	58.61	.2990	.5468	9
Teacher experience	.59459	58.17	.2983	.5462	10
Activities (English)	.59697	57.82	.2965	.5445	11
Mexican-American percentage squared	.60087	57.26	.2952	.5433	12
Teacher Spanish	.60380	56.84	.2945	.5427	13
Bilingual instruction (hours/day)	.60638	56.47	.2926	.5409	14
Sesame Street	.60827	56.20	.2927	.5410	15
Educational TV	.60975	55.99	.2931	.5414	16
Aide	.61205	55.66	.2914	.5398	17
Mexican-American percentage squared	.61437	55.33	.2897	.5382	18
Teacher Spanish	.61637	55.04	.2882	.5368	19
Pretest	.61792	54.82	.2870	.5357	20
Bilingual instruction (days)	.61963	54.57	.2857	.5345	21
Teacher MA	.62110	54.36	.2846	.5335	22
Activities (English)	.62258	54.15	.2835	.5325	23
Pretest	.62393	53.96	.2825	.5315	24
Bilingual instruction (days)	.62502	53.80	.2817	.5307	25
Grade	.62587	53.68	.2825	.5315	26
Teacher Spanish	.62674	53.55	.2819	.5309	27
Color TV	.62746	53.45	.2828	.5318	28
Aide Spanish	.62816	53.35	.2838	.5327	29
Educational TV	.62917	53.20	.2830	.5320	30
Final Values	.6466	50.71	.2786	.5278	

Table 13

Spanish History/Culture Starting Model

Variable	Raw Weight	Standardized Weight	Correlation with Criterion	Entry
Viewing frequency	.0320	.398040	.1939	3
Activities (any)	-.2206	-.114627	.0990	17
Activities (Spanish)	-.0227	-.013539	.2733	21
Activities (English)	-.4158	-.239736	-.0522	5
Color TV	.1588	.080315	.1949	14
Sex	.0489	.029148	.1050	18
Teacher MA	-.2450	-.102019	-.1406	4
Teacher experience	-.0087	-.091600	-.1389	8
Teacher Spanish	-.0798	-.102414	.2237	10
Aide	-.3326	-.195204	.1291	6
Aide Spanish	-.1141	-.068003	.1194	15
Bilingual instruction (days)	.0296	.082588	.4568	2
Bilingual instruction (hours/day)	.1060	.295434	.3733	7
Bilingual instruction (hours/week)	0.000^{0}	0.000000	.3587	0
Percentage Mexican-American	0.0000	0.000000	.2914	0
Class size	.0054	.038550	.0172	16
Sesame Street	.3247	.135212	.0540	11
Grade	.0844	.082463	.2967	13
Educational TV	-.1432	-.170394	-.0202	12
Teacher experience squared	.0001	.039676	-.1738	20
Bilingual instruction (hours/day) squared	0.0000	0.000000	.3216	0

Table 13 (continued)

Variable	Raw Weight	Standardized Weight	Correlation with Criterion	Entry
Bilingual instruction (hours/week) squared	-.0003	-.107633	.3182	19
Percentage Mexican-American squared	.0001	.263998	.3270	9
Class size squared	0.0000	0.000000	-.0454	0
Pretest	.8256	.532019	.6681	1
Unit Vector	.2471			

restricted models, as discussed below. (For reference, the means, standard deviations, variance, and correlation matrices of all variables in the predictor and criterion sets for both the prevalidation and cross-validation samples are reported in Appendix C.)

Visual inspection of the error mean square at each step of the iteration process (Table 12) reveals that entries in the last five steps of the iteration process being to fluctuate and are all greater than the lowest error mean square of .2817 which resulted at iteration step number 25. As can be seen in Table 12, the values of the error mean square and RSQ at iteration 25 are quite close to the final values attained with all the predictors in the starting model. This fact, considered in conjunction with the fluctuation or the error mean square in subsequent iterations, suggests that predictors added to the equation after step 25 contribute little additional predictive power or accuracy. Selecting the predictors incorporated in the equation at a point a few steps beyond iteration 25 should ensure that the most useful predictors are included in the restricted models. The variables which had been selected from the predictor set at iteration step 28 were, therefore, selected as the predictor set for the largest restricted model. Other restricted models were constructed by successively dropping out predictor variables in the reverse order of their entry into the equation for the starting model. This procedure resulted in 14 restricted models with predictor sets as shown in Table 14. These models were subjected to

Table 14

Spanish History/Culture
Restricted Models

Predictor Variables	Model Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	F-ratio**
Pretest	*	*	*	*	*	*	*	*	*	*	*	*	*	*	81.4149
Bilingual instruction (days)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	71.9509
Viewing frequency		*	*	*	*	*	*	*	*	*	*	*	*	*	58.9082
Teacher MA			*	*	*	*	*	*	*	*	*	*	*	*	50.4128
Activities (English)				*	*	*	*	*	*	*	*	*	*	*	46.0120
Aide					*	*	*	*	*	*	*	*	*	*	40.2964
Bilingual instruction (hours/day)						*	*	*	*	*	*	*	*	*	37.2284
Teacher experience							*	*	*	*	*	*	*	*	33.7283
Mexican-American percentage squared									*	*	*	*	*	*	31.3792
Teacher Spanish										*	*	*	*	*	28.9232
Sesame Street											*	*	*	*	26.5328
Educational TV												*	*	*	24.9777
Grade													*	*	23.4137
Color TV														*	22.0295

*Indicates predictor variable was included in model.
**All F-ratios significant ($p<.01$).

F-tests to determine whether each model yielded prediction significantly different from chance. Resultant F-ratios are also reported in Table 14, where it can be seen that all models yielded F-ratios significant at an alpha level less than .01. At this point, 14 models had been constructed, all of which yielded predictions of the criterion significantly better than chance. These models, furthermore, were expected to include an optimum model for the prediction of Spanish History/Culture scores. The number of possible models under consideration had been reduced in the first six steps of the research strategy to 14 models.

Cross-validation

The final step in the research strategy was to select a single model as the optimum model. Among the fourteen models, some of the models, as noted above, may have been "overfitted" to the prevalidation data sample. On the other hand, some of the models did not provide the maximum predictive power possible, as indicated by the relative size of RSQ. The optimum model was defined, therefore, as that model which provided a maximum RSQ, when applied to the data of the cross-validation sample. The selection of such a model avoided most of the problem of "overfitting," while also maximizing predictive power.

The 14 restricted models were subjected to cross-validation in two ways. First, a least squares solution was computed

for each model using data from the prevalidation sample. The resultant solution was applied to the data from the cross-validation sample to produce a cross-validated RSQ. Second, a least squares solution was computed for each model using data from the cross-validation sample. These resultant solutions were applied, in turn, to the data of the prevalidation sample. The RSQ's obtained from these computations are presented in Table 15. As can be seen in the table, where the least squares weights from the prevalidation sample were applied to the data of the cross-validation sample, the cross-validated RSQ attained a maximum value (.6849) using the predictor set of model 8. Cross-validated RSQ's using least squares weights from the cross-validation sample attained a maximum value (.5874) using the predictor sets from models 13 and 14. Since model 8 is more parsimonious than models 13 or 14, in that model 8 incorporates fewer predictors, the properties of this model were further investigated.

Optimum Model

The least squares solution to model 8 using data from the prevalidation sample produces an equation which is considered to be the optimum model for predicting Spanish History/Culture posttest scores. The predictors, weights, and summary statistics for this model are presented in Table 16. The raw weights give a direct indication of the influence a particular predictor has upon the criterion. For example, the raw weight for viewing

Table 15

Spanish History/Culture

Cross-validations[a]

Model Number	Cross-validating from Sample 1 to Sample 2		Cross-validating from Sample 2 to Sample 1	
	Sample 1 LSS[b] RSQ	Sample 2 CV[c] RSQ	Sample 2 LSS[b] RSQ	Sample 1 CV[c] RSQ
1	.4463	.6105	.6105	.4463
2	.5178	.6240	.6374	.5057
3	.5409	.6539	.6679	.5284
4	.5588	.6579	.6759	.5436
5	.5821	.6609	.6803	.5578
6	.5887	.6583	.6808	.5623
7	.6029	.6833	.7100	.5745
8	.6087	.6849	.7108	.5786
9	.6176	.6789	.7108	.5786
10	.6217	.6758	.7110	.5787
11	.6225	.6778	.7122	.5770
12	.6291	.6786	.7141	.5824
13	.6322	.6773	.7154	.5874
14	.6350	.6789	.7154	.5874

[a]Sample 1 was the prevalidation sample used for construction of starting and restricted models. Sample 2 was the sample reserved for cross-validation.

[b]Least squares solution

[c]Cross-validated

Table 16

Spanish History/Culture

Optimum Model

Variable	Raw Weight	Standardized Weight	Correlation with Criterion	Entry
Pretest	.9205	.5932	.6681	1
Bilingual instruction (days)	.0450	.1255	.4568	2
Viewing frequency	.0297	.3701	.1939	3
Teacher MA	-.3086	-.1285	-.1406	4
Activities (English)	-.3914	-.2257	-.0522	5
Aide	-.2214	-.1299	.1291	6
Bilingual instruction (hours/day)	.0582	.1623	.3733	7
Teacher experience	-.0065	-.0687	-.1389	8
Unit Vector	.2576			

Multiple Correlation Coefficient Squared (RSQ)	= .6087
Multiple Correlation Coefficient (R)	= .7802
Error Sum of Squares	= 56.14
Error Mean Square	= .2879
Standard Error of the Estimate	= .5366

frequency is .0297. This weight indicates that an increase of .0297 in the posttest score is predicted for each unit increase in viewing frequency. For each additional Carrascolendas program viewed by the child, in other words, an increase of .0297 in his posttest score would be predicted, other things being equal.

The sign of the raw weight gives an indication of whether a particular predictor variable represents an addition to the child's posttest score or a subtraction from the score, if all other predictor variables are held constant. For example, if bilingual instruction is conducted in the child's class, a higher posttest score would be predicted than if bilingual instruction is not conducted. On the other hand, if supplementary activities are conducted in English, a lower posttest score is predicted.

The range of possible values taken on by a predictor variable should also be considered in evaluating the relative relationship of predictor variables to the posttest score criterion. For example, if the child viewed 27 Carrascolendas programs, a posttest increase of .8019 would be predicted above the score of a child who viewed none of the programs. In comparison, bilingual instruction cannot be conducted more than five days per week, nor more than six hours per day, assuming the school day for lower elementary children is six hours long. If bilingual instruction is conducted this maximum amount, then an increase of .5742 in the child's posttest score would be predicted.

The relative values of these predicted posttest increases are suggestive of the outcomes that might result from selecting one or the other of these activities to enhance the child's knowledge of history/culture. Table 17 presents the range of possible values and the maximum increase (or decrease) in posttest score associated with each of the predictors in model 8. In the case of teacher experience, the range of values actually observed in the data set has been reported in the table.

If desired, predicted gain scores can also be computed from the information given in the model. For example, it may be of interest to know the predicted difference in gain scores for two children who have different pretest scores, but who are equal with respect to all other predictor variables. For a child whose pretest score is 2.0, a posttest score of about 2.10 is predicted (Posttest Score = [.9205 X Pretest Score of 2.0] + [.2576 X Unit Vector of 1]). The gain score for this child is 0.10. For a child whose pretest score is 3.0, a posttest score of about 3.02 is predicted. The gain score for this child, then is 0.02. The difference in gain scores is 0.08. Other predictors may, of course, be included in the calculation. If the child whose pretest score was 2.0 had viewed 27 programs, then a posttest score of about 2.90 is predicted. If the child whose pretest score was 3.0 had only viewed 15 programs, then a posttest score of about 3.46 is predicted. Here the difference in gain scores is 0.44. Although it is difficult to visualize a multivariate

Table 17
Spanish History/Culture

Range of Values and Change in Criterion

Associated with Predictors in Optimum Model

Predictor	Range of Values	Maximum Change in Criterion (Posttest Score)
Unit vector	1	.2576
Pretest	1-4	3.682
Bilingual instruction (days)	0-5	.2250
Viewing frequency	0-27	.8019
Teacher MA	0-1	-.3086
Activities (English)	0-1	-.3914
Aide	0-1	-.2214
Bilingual instruction (hours/day)	0-6	.3492
Teacher experience	0-38	-.2470

picture of these results as more variables are added to the equation, a simple two-variable relationship is easily shown in graphic form. Figure 4 presents a graph illustrating the relationship of viewing frequency and predicted posttest scores in Spanish History/Culture.

English Science Model Construction

As stated above, identical procedures were used for model construction for both criterion vectors. The same basic set of predictors, furthermore, was used in both models. The pretest and pretest squared vectors were, of course, those associated with the criterion vector, posttest scores on the English subtest of Science in the following instance.

Linearity Tests

Linearity tests were conducted on the relationship of each continuous variable with the criterion. As can be seen in Table 18, the results indicated that the curvilinear form of the equation was significantly different from the straight line form for five predictor variables. Squared terms for these five variables, therefore, were included in the starting model for the prediction of English Science posttest scores.

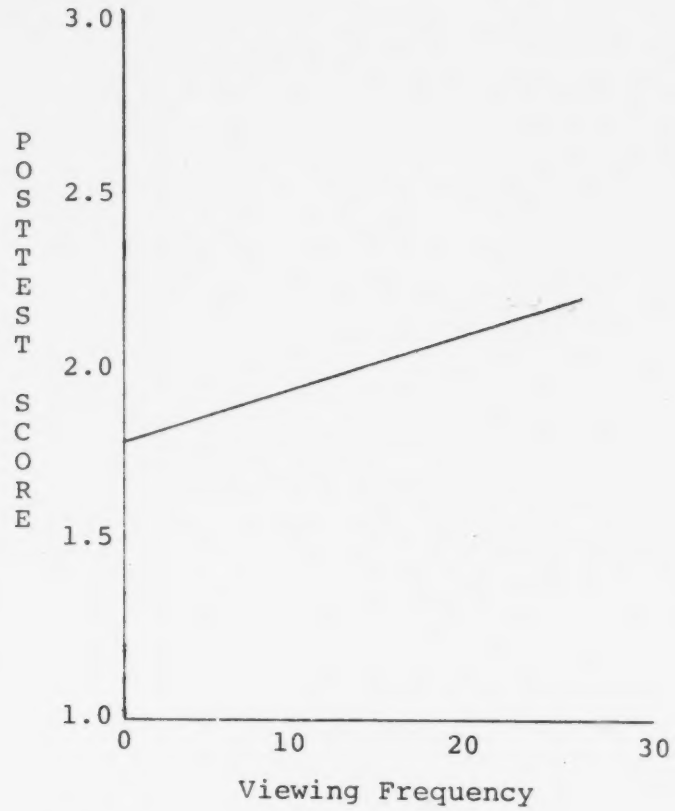

Figure 4. Spanish History/Culture Posttest Score versus Viewing Frequency

Table 18

F-tests for Curvilinearity in English Science Predictors

Variable Name	RSQ Curvilinear Form	RSQ Straight Line Form	F-ratio
Pretest	.5072	.4782	11.8266*
Viewing frequency	.0231	.0221	.2032
Educational TV	.0599	.0581	.3784
Grade	.1839	.1678	3.9667*
Bilingual instruction (days)	.0227	.0019	4.2695*
Bilingual instruction (hours/day)	.0037	.0020	.3350
Bilingual instruction (hours/week)	.0031	.0025	.1275
Teacher experience	.0292	.0094	4.1110*
Teacher Spanish	.0594	.0005	12.5825*
Mexican-American percentage	.0634	.0562	1.5644
Class size	.0037	.0005	.6525

*$p < .05$

Model Construction

Again, a least squares solution for the starting model was calculated with a computer program which used an iterative process (Ward & Jennings, 1973, p. 317). The stop-criterion for the iteration process was set at .0001. The first 40 iterations are presented in Table 19, where it can be seen that fluctuation in the error mean square beings at iteration 33, with the introduction of the vector for "Bilingual instruction (days) squared" into the equation. The introduction of the next new vector, "Teacher Spanish" also causes a rise in the error mean square (iteration 40). The sixteen variables which had been selected from the predictor set at iteration step 40 were, therefore, selected as the predictor set to begin construction of restricted models. The final form of the starting model is presented in Table 20. As expected, this equation is quite different from the equation of the starting model for Spanish History/Culture. In other words, each of the different subtest area scores is best predicted from different predictor sets. Of particular interest in this study was the fact that viewing frequency was not included in the least squares solution of the starting model for predicting English Science scores.

Restricted models were constructed by using the sixteen predictor variable set and successively dropping out predictors in the reverse order of their entry into the equation for the starting model. This procedure resulted in 16 restricted models

Table 19

English Science Iteration Sequence for Starting Model

Variable	RSQ	Error Sum of Squares	Error Mean Square	Standard Error of Estimate	Iteration
Pretest	.47821	63.39	.3138	.5602	1
Mexican-American percentage	.52864	57.26	.2849	.5338	2
Teacher experience squared	.55404	54.18	.2709	.5205	3
Color TV	.56741	52.55	.2641	.5139	4
Pretest squared	.57834	51.23	.2587	.5086	5
Grade	.58899	49.93	.2535	.5034	6
Aide Spanish	.59422	49.30	.2515	.5015	7
Aide	.60095	48.48	.2486	.4986	8
Aide Spanish	.60542	47.94	.2458	.4958	9
Activities (Spanish)	.61038	47.33	.2440	.4939	10
Educational TV	.61304	47.01	.2436	.4935	11
Aide Spanish	.61678	46.55	.2412	.4911	12
Aide	.61966	46.21	.2394	.4893	13
Teacher experience squared	.62298	45.80	.2373	.4872	14
Pretest squared	.62781	45.22	.2343	.4840	15
Mexican-American percentage	.63150	44.77	.2320	.4816	16
Sesame Street	.63350	44.52	.2319	.4816	17
Teacher Spanish squared	.63630	44.18	.2313	.4810	18
Activities (English)	.63802	43.98	.2314	.4811	19
Mexican-American percentage	.63985	43.75	.2303	.4799	20
Pretest squared	.64251	43.43	.2286	.4781	21
Teacher experience squared	.64488	43.14	.2271	.4765	22
Mexican-American percentage	.64636	42.96	.2261	.4755	23
Pretest squared	.64778	42.79	.2252	.4746	24
Educational TV	.64887	42.66	.2245	.4738	25
Sesame Street	.64995	42.53	.2238	.4731	26
Bilingual instruction (hours/week)	.65087	42.41	.2244	.4737	27

Table 19 (continued)

Variable	RSQ	Error Sum of Squares	Error Mean Square	Standard Error of Estimate	Iteration
Activities (Spanish)	.65236	42.23	.2235	.4727	28
Aide Spanish	.65313	42.14	.2230	.4722	29
Educational TV	.65395	42.04	.2224	.4716	30
Mexican-American percentage	.65448	41.98	.2221	.4713	31
Adie Spanish	.65513	41.90	.2217	.4708	32
Bilingual instruction (days) squared	.65562	41.84	.2225	.4717	33
Bilingual instruction (hours/week)	.65616	41.77	.2222	.4714	34
Teacher experience squared	.65657	41.72	.2219	.4711	35
Bilingual instruction (days) squared	.65702	41.67	.2216	.4708	36
Pretest squared	.65760	41.60	.2213	.4704	37
Mexican-American percentage	.65817	41.53	.2209	.4700	38
Teacher Spanish squared	.65876	41.46	.2205	.4696	39
Teacher Spanish	.65929	41.39	.2213	.4705	40
Final Values	.6687	40.25	.2176	.4664	

Table 20

English Science Starting Model

Variable	Raw Weight	Standardized Weight	Correlation with Criterion	Entry
Viewing frequency	.0000	.000000	.1487	0
Activities (any)	.0000	.000000	.1946	0
Activities (Spanish)	-.2592	-.167943	.1301	9
Activities (English)	.0953	.059737	.1718	13
Color TV	-.4246	-.233391	-.0578	4
Sex	-.0260	-.016839	-.0124	17
Teacher MA	.0000	.000000	-.0018	0
Teacher experience	.0000	.000000	.0968	0
Teacher Spanish	-.1337	-.186346	.0231	16
Aide	-.3689	-.235266	.0223	8
Aide Spanish	.6315	.408983	.0358	7
Bilingual instruction (days)	.0000	.000000	.0439	0
Bilingual instruction (hours/day)	.0000	.000000	-.0447	0
Bilingual instruction (hours/week)	.0052	.078834	-.0499	14
Percentage Mexican-American	.0039	.216851	.2370	2
Class size	-.0023	-.017510	.0218	18

Table 20 (continued)

Variable	Raw Weight	Standardized Weight	Correlation with Criterion	Entry
Sesame Street	-.3158	-.142893	.0057	11
Grade	.1888	.200456	.4097	6
Educational TV	.1429	.184872	.2411	10
Teacher experience squared	.0004	.145896	.1349	3
Teacher Spanish squared	.0589	.277140	.0829	12
Bilingual instruction (days) squared	-.0040	-.061902	.0250	15
Grade squared	.0000	.000000	.3876	0
Pretest	1.5605	1.447537	.6915	1
Pretest squared	-.2082	-.86-881	.6432	5
Unit vector	-.3534			

with predictor sets as shown in Table 21. As shown by the associated F-ratios in Table 21, all of the restricted models yielded predictions significantly better than chance at an alpha level less than .01.

Cross-validation

In order to select an optimum model from among the 16 restricted models, each model was subjected to cross-validation. Cross-validation procedures were the same as those used with the Spanish History/Culture models. Again, the optimum model was defined as that model which provided the maximum cross-validated RSQ. Where the least squares weights from the prevalidation sample were applied to the data of the cross-validation sample, the maximum cross-validated RSQ (.5163) was attained using the predictor set of model 9 (Table 22). Cross-validated RSQ's using least squares weights from the cross-validation sample attained a maximum value (.6175) using the predictor sets from models 15 and 16 (Table 22). Coincidentally, these results are similar to the results of cross-validations for the Spanish History/Culture restricted models.

The values of the cross-validated RSQ's, going either from the prevalidation to the cross-validation sample or vice versa, indicate that model 9 is the optimum model for predicting English Science scores.

Optimum Model

The predictors, weights, and other statistics for the

Table 21

English Science

Restricted Models

Predictor Variables	Model Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	F-ratio**
Pretest	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	92.5648
Mexican-American percentage		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	75.1417
Teacher experience squared			*	*	*	*	*	*	*	*	*	*	*	*	*	*	62.2275
Color TV				*	*	*	*	*	*	*	*	*	*	*	*	*	53.1809
Pretest squared					*	*	*	*	*	*	*	*	*	*	*	*	46.9219
Grade						*	*	*	*	*	*	*	*	*	*	*	42.3402
Aide Spanish							*	*	*	*	*	*	*	*	*	*	37.7700
Aide								*	*	*	*	*	*	*	*	*	36.5218
Activities (Spanish)									*	*	*	*	*	*	*	*	33.3370
Educational TV										*	*	*	*	*	*	*	31.8587
Sesame Street											*	*	*	*	*	*	29.5190
Teacher Spanish squared												*	*	*	*	*	27.6680
Activities (English)													*	*	*	*	26.1365
Bilingual instruction (hours/week)														*	*	*	24.4317
Bilingual instruction (days) squared															*	*	23.0927
Teacher Spanish																*	22.7155

*Indicates predictor variable was included in the model.
**All F-ratios significant ($p<.01$).

Table 22

English Science

Cross-validations[a]

Model Number	Cross-validating from Sample 1 to Sample 2		Cross-validating from Sample 2 to Sample 1	
	Sample 1 LSS[b] RSQ	Sample 2 CV[c] RSQ	Sample 2 LSS[b] RSQ	Sample 1 CV[c] RSQ
1	.4782	.4692	.4692	.4782
2	.5286	.4714	.4852	.5169
3	.5545	.4882	.5021	.5414
4	.5719	.4913	.5068	.5532
5	.5864	.4886	.5113	.5689
6	.5999	.4997	.5209	.5816
7	.6058	.5080	.5297	.5869
8	.6271	.5143	.5361	.6040
9	.6318	.5163	.5403	.6086
10	.6444	.5061	.5403	.6086
11	.6480	.5061	.5399	.6074
12	.6523	.5011	.5418	.6104
13	.6574	.5100	.5476	.6168
14	.6587	.5111	.5497	.6160
15	.6611	.5097	.5504	.6175
16	.6706	.5032	.5504	.6175

[a]Sample 1 was the prevalidation sample used for construction of starting and restricted models. Sample 2 was the sample reserved for cross-validation.

[b]Least squares solution

[c]Cross-validated

optimum model are given in Table 23. The raw weights, along with their signs, indicate the influence a particular predictor has upon the criterion. For example, the predicted posttest score for children who view Carrascolendas on a color television is .3107 less than the score predicted for children who view the series in black-and-white. In contrast, a child in the second grade would have a predicted score .1571 higher than a child in the first grade, if other conditions were equal. It should be noted that some of the predictors can be considered only in sets. A two-unit increase in pretest score, for instance, implies an increase in posttest score of 2.72 units. Since "Pretest Squared" is also in the predictor set, however, the predicted increase in posttest score should be $2.11\ (2.72 - [(.1523) \times (2)^2])$. The complete range of values and the maximum change in posttest score associated with each predictor is given in Table 24.

The optimum models for predicting Spanish History/Culture and English Science posttest scores are quite different in terms of their predictor sets. Other than the appropriate pretest score, only the binary measure of whether or not a teacher aide is present in the child's class appears in both predictor sets, with a negative weight in both cases. The measure of viewing frequency of Carrascolendas appears in the Spanish History/Culture model, but not in the English Science model. The models have a similar number of predictors (8 and 9), probably coincidentally. The predictive power and accuracy of both models,

Table 23

English Science

Optimum Model

Variable	Raw Weight	Standardized Weight	Correlation with Criterion	Entry
Pretest	1.3622	1.263613	.6915	1
Mexican-American percentage	.0053	.294606	.2370	2
Teacher experience squared	.0004	.163051	.1349	3
Color TV	-.3107	-.170805	-.0578	4
Pretest squared	-.1523	-.629481	.6432	5
Grade	.1571	.166848	.4097	6
Aide Spanish	.4922	.318796	.0358	7
Aide	-.3793	-.294606	.0223	8
Activities (Spanish)	-.1579	-.102286	.1301	9
Unit Vector	-.1786			

Multiple Correlation Coefficient Squared (RSQ)	= .6318
Multiple Correlation Coefficient (R)	= .7948
Error Sum of Squares	= 44.73
Error Mean Square	= .2306
Standard Error of the Estimate	= .4802

Table 24

English Science

Range of Values and Change in Criterion

Associated with Predictors in Optimum Model

Predictor	Range of Values	Maximum Change in Criterion (Posttest Score)
Unit Vector	1	-.1786
Pretest	1-4	5.4488
Mexican-American percentage	0-100	.5300
Teacher experience squared	0-1444	.5776
Color TV	0-1	-.3107
Pretest squared	1-16	-2.4368
Grade	1-3	.4713
Aide Spanish	0-1	.4922
Aide	0-1	-.3793
Activities (Spanish)	0-1	-.1579

furthermore, appears to be about the same, with RSQ values of about .60.

Chapter IV

Discussion

Summary of the Study

This study focused on the development of a quantitative model for the prediction of learning effects of a bilingual children's educational television program series. A further aim was to assess the modeling procedure used in the study.

The stimulus program series consisted of 30 half-hour programs in the third-year series of Carrascolendas, a Spanish-English series designed to supplement bilingual classroom instruction. The series was based upon specified behavioral objectives grouped into the content areas of Self Concept, History/Culture, Spanish Language Skills, English Language Skills, Phoneme/Grapheme Relations, Science, and Math.

Learning effects were measured with pre and postseries criterion referenced tests, where test items represented a sampling of the behavioral objectives of the program series. Tests were administered in oral interviews conducted in both Spanish and English with 408 Mexican-American children in kindergarten, first grade, and second grade at nine test sites across the nation. Data on independent variables were collected on measures of communication stimuli, individual characteristics, and

contextual characteristics. These measures were completed by the children's classroom teachers and field testing staff.

The predictive models developed in this study were constructed through linear multiple regression analysis. The criterion variables were postseries criterion referenced test scores and the predictor variables were the measures of communication stimuli and individual and contextual characteristics. The desired model was a multivariate model which would show the relationship of learning effects to frequency of viewing the program series in combination with other independent variables such as individual and contextual characteristics. Such a model would permit not only description of the impact of program viewing on learning effects, but also description of the influence of the other factors in moderating the learning effects resulting from program viewing. It was highly desirable, therefore, that program viewing frequency be strongly associated with learning effects. If viewing frequency was not in the model, then little or nothing could be said about the relationship of viewing frequency to other independent variables in the attainment of learning effects. On the basis of prior contract evaluation research, scores on the Spanish subtest in the content area of History/Culture and the English subtest of Science appeared to be the only dependent variables which were reliably and consistently related to program viewing. These two variables were, therefore, selected as the criterion variables for separate models developed through

linear multiple regression analysis, where predictor variables were the measures of communication stimuli and individual and contextual characteristics.

The basic research strategy was one of model-seeking, where multiple regression analysis was used to reduce the number of predictor variables for incorporation in an optimum predictive model. As can be seen in Table 25, the optimum models for predicting Spanish History/Culture scores and English Science scores have nine and ten predictors respectively. Table 25 also presents summary statistics for comparing the two models in the following discussion.

Summary of the Research Questions and Results

The properties of the optimum models constructed for the prediction of scores on the Spanish subtest of History/Culture and the English subtest of Science provide the basis for answering the research questions posed for this study.

Prediction of Effects

The first research question was: To what degree can learning effects be predicted upon the basis of characteristics of the instructional communication treatment, the individual student characteristics, and the contextual variables? In summary, the results indicate that learning effects can be predicted with

Table 25

Summary of Optimum Models

Spanish History/Culture				English Science			
Variable	Raw Weight	Range	Maximum Change in Criterion	Variable	Raw Weight	Range	Maximum Change in Criterion
Pretest	.9205	1-4	3.682	Pretest	1.3622	1-4	5.4488
Bilingual instruction (days)	.0450	0-5	.2250	Mexican-American percentage	.0053	0-100	.5300
Viewing frequency	.0297	0-27	.8019	Teacher experience squared	.0004	0-1444	.5776
Teacher MA	-.3086	0-1	-.3086	Color TV	-.3107	0-1	-.3107
Activities (English)	-.3914	0-1	-.3914	Pretest squared	-.1525	1-16	-2.4368
Aide	-.2214	0-1	-.2214	Aide Spanish	.4922	0-1	.4922
Bilingual instruction (hours/day)	.0582	0-6	.3492	Aide	-.3793	0-1	-.3793
Teacher experience	-.0065	0-38	.2470	Activities (Spanish)	-.1579	0-1	-.1579
Unit vector	.2576	1	.2576	Unit vector	-.1786	1	-.1786

Error Sum of Squares	56.14	Error Sum of Squares	44.73
Error Mean Square	.2879	Error Mean Square	.2306
Standard Error of the Estimate	.5366	Standard Error of the Estimate	.4802
Coefficient of Multiple Correlation (R)	.7802	Coefficient of Multiple Correlation (R)	.7948
Percentage Reduction in Errors of Prediction	37.45	Percentage Reduction in Errors of Prediction	39.32
Coefficient of Multiple Correlation Squared (RSQ)	.6087	Coefficient of Multiple Correlation Squared (RSQ)	.6318
Cross-validated RSQ	.6849	Cross-validated RSQ	.5163
Least Squares RSQ for Cross-validation Sample	.7108	Least Square RSQ for Cross-validation Sample	.5403
RSQ Using Pretest Only as a Predictor	.4463	RSQ Using Pretest Only as a Predictor	.4782

relatively high degrees of reliability and accuracy. The term "relatively" is a necessary qualification. Guilford and Fruchter (1973) point out that correlations of .8 are about the highest level "usually found for useful predictive instruments in psychological and educational practice [p. 347]." The coefficient of multiple correlation (R) for both the Spanish History/Culture and the English Science models is nearly .8. The square of this coefficient (RSQ), furthermore, is about .6 for both models, indicating that about 60% of the variance in criterion scores is accounted for by the predictor variables incorporated in the models. Finally, the cross-validated RSQ's for both models are only 4% lower than the RSQ from a least squares solution to the model using data from the cross-validation sample. The least squares solution yields the maximum RSQ for a given model and a given sample of data. These values of R and RSQ indicate that predictions based on these models have a generally high degree of reliability.

The accuracy of these models is best judged in terms of the reduction in errors of prediction based upon the models, compared with predictions made without the model. This reduction amounts to about 37% for both models. Taken at its face value, this reduction may not seem very high. However, in relative terms the reduction is quite high. For example, if the criterion (posttest scores) were predicted upon the basis of knowledge of pretest scores alone, errors of prediction would be 26% less than predictions made without knowledge of pretest scores. This

percentage is increased again by almost half (to 37%) with the inclusion of the other predictor variables in the model. For prediction in education and psychology in general, a 37% reduction in errors of prediction is quite substantial (Guilford & Fruchter, 1973).

Implications

The second research question in the study was: If a reliable model for predicting learning effects can be developed: (a) What are the practical implications for policy decisions on children's bilingual educational television? (b) What are the implications for theorizing about the communication effects of educational television?

Implications for policy decisions. The most general implication of the results of this study is that policy decisions regarding educational television must be formulated in terms of contextual characteristics, as well as program content and objectives. For example, the Carrascolendas series enhanced learning in History/Culture; but, in classrooms where a teacher aide was present, students did not generally achieve posttest scores as high as otherwise. In other words, the impact attributed to the program in one classroom may not generalize to another classroom. This finding, in itself, is not surprising. The third-year contract evaluation revealed that the effects of the program series were different in different sites (see Table 5, Chapter One). Although the contract evaluation did not analyze these site

differences, the present study provides some insight into the problem. Differences in teaching staff and classroom activities not only influence learning effects, but, in some instances, are more salient predictors of learning effects than frequency of viewing the program series (as in English testing in the Science content area). These findings are probably of more practical importance to the teacher and educational administrator than to the producer of the program series.

For the teacher or administrator, the models answer questions such as:

(1) Will the program series enhance learning?

(Yes, in some areas.)

(2) Will the series be effective, even when it is used in classrooms with no bilingual instruction program?

(Yes. Again, however, only in certain content areas, particularly History/Culture.)

(3) Can the program series be used as a substitute for hiring a teacher aide?

(A teacher aide may be very useful in other ways; however, the present study revealed that children in classrooms with a teacher aide made lower post-test scores than otherwise. It must be remembered that tests were tied directly to the objectives of the program series. A teacher aide is apparently of no benefit, at least in the areas of History/

Culture and Science.)

(4) If the program series is viewed in the classroom, can the children benefit from watching some, but not all of the series?

(Yes. Findings in the present study indicate that the more programs the children view, the most they benefit. There may be a lower limit, where viewing is essentially of no benefit, but that contingency was not investigated in the present study.)

Answers to questions such as these are best understood, of course, in the context of the entire study. For example, it is tempting to conclude that viewing the program series in color has an adverse effect on Science posttest scores, since color TV has a negative weight in the optimum model for predicting English Science scores (Table 25). This result, however, may be an artifact of the analysis. Only children in San Antonio and Tucson viewed the series on color television sets. The color TV predictor, therefore, may be more tied to the results in these two sites, than to the general effect of viewing the series in color. The children in these sites generally had lower scores than in other sites. The color TV predictor may have a negative weight, therefore, simply because it is differentiating the children in San Antonio and Tucson from children in other sites.

Another, and perhaps more practical, problem in interpreting the results in the English Science optimum model is that

frequency of viewing the Carrascolendas series is not included in the predictor set. It is difficult to accept the notion that viewing the series in color detracts from posttest achievement, when there is no salient relationship between posttest scores and viewing the series at all. Again, it seems more appropriate to conclude that the color TV predictor represents a difference in site results, rather than true differences in program viewing conditions.

The color TV predictor is the only predictor in either of the optimum models (Table 25) that is so tied to particular sites. It should be noted, however, that the teacher MA predictor represents a variable that was not very well sampled, i.e., only about 15% of the teachers reported having an MA degree. Effects attributed to this variable, therefore, should be regarded with some caution. In general, the remaining predictors in both models do not suffer from the limitations of interpretation noted in regard to color TV and teacher MA.

One of the most interesting findings in the present study, for example, is that supplementary activities conducted in the language opposite that in which program materials were presented and tested appear to result in lower posttest scores. In the optimum model for predicting History/Culture scores in Spanish testing (see Table 25), supplementary activities conducted in English is a salient predictor with a negative weight. Likewise, in the model for predicting Science scores in English testing (see Table

25), supplementary activities in Spanish has a negative weight. About 50% of the children in this study participated in supplementary activities conducted in Spanish, with about 60% participating in activities conducted in English (Appendix C). Apparently when program materials are presented in one language and activities in the opposite language, a linguistic conflict occurs which produces confusion rather than enhancing learning of the program content.

A similar problem may exist when a teacher aide is present in the classroom. This predictor is the only predictor which is salient for both the prediction of Spanish History/Culture and English Science scores. In both models the aide predictor has a negative weight. This is somewhat surprising, since one would generally assume that an aide would provide more individual attention to the viewer child. Such attention should enhance learning and posttest scores. Why this does not appear to be the case is open to question, but, perhaps, there is some confusion or conflict between information presented by the program or teacher and information presented by the aide. Further research is necessary to resolve this question.

There were, of course, limitations in this study. The possible value of repeated viewing of programs, for example, could not be analyzed. Other than differences in pretest scores, there were only two measures of individual differences, sex and grade level. In the present study, effects in Spanish History/Culture

were generalizable across both sex and grade level, while effects in English Science were generalizable across sex, but not across grade level. Further investigation of the influence of other individual differences would be desirable. More detailed measures of contextual characteristics, such as supplementary activities, would also be desirable.

For producers or administrators in charge of program funding, the greatest value of this study comes from the evaluation procedure utilized. The construction of linear models has yielded greater insight into the effects of the program series than other types of analyses have offered. For example, the third-year contract evaluation only showed that there were significant viewer-nonviewer differences favoring viewer gains in Spanish testing in the History/Culture content area. The present study, in contrast, reveals that increased frequency of viewing results in increased learning in the History/Culture area, that the magnitude of this benefit is at least equal to the benefit of a general program of bilingual instruction, and that increases in the amount of bilingual instruction results in increased posttest scores. Other salient predictors indicate that children generally make lower posttest scores when they participate in supplementary activities conducted in English or when they are in classrooms with a teacher aide or with more experienced teachers. (Perhaps teachers who have taught longer have more difficulty incorporating educational television into their curricula.)

The construction of linear models may also clarify results obscured in other types of analysis. English posttest scores in Science were significantly and positively correlated with frequency of viewing the program series. This correlation seemed to confirm the results of the third-year contract evaluation, where significant viewer-nonviewer differences were found in English testing in the Science area. The present analysis, however, indicates that viewing frequency had little, if any, affect on posttest scores beyond that attributable to other factors. In other words, the program series had little if any unique affect on Science scores. A problem in conducting research on Carrascolendas is that the series is designed to supplement rather than replace bilingual curricula. In some content areas, the series may present information that is highly redundant with classroom instruction. The unique effects of the series in these areas will consequently be quite small. Science may be such a content area. In contrast, the series appears to have significant, unique effects in the content area of History/Culture. Whether or not an educational television series is to be evaluated in terms of unique effects should be decided and specified early in the initial design of the series.

Unfortunately, the data analyzed in the present study did not include measures of many variables that are of great interest to program producers and funding agencies. Fiscal questions, for example, center on the relative cost-effectiveness of different

production techniques. The relative effectiveness of different production techniques, such as animation or dramatic skits, however, was not investigated in this study. Although program producers may be enlightened by the findings of the present study, answers to their central questions of production cost-effectiveness must await further research.[1]

Overall, the construction of linear models through the use of multiple regression analysis has proven to be a useful tool for multivariate analysis of the effects of educational television. While the results of the present study may be of greatest value to potential users of educational television, the evaluation technique utilized has potential value for producers and fund administrators engaged in formative or summative research.

Implications for communication theory. This study was an implementation of a multivariate view of communication. The results of this study confirm the view that a communication stimulus, such as an educational television program series, functions as one of a variety of stimuli in producing learning effects. Relatively accurate, reliable predictions of effects can be made when contextual characteristics are considered in conjunction with characteristics of the communication stimulus. Past

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[1]A fiscal analysis of Carrascolendas is forthcoming in F. Korman, Toward a model of cost-effectiveness analysis for educational television. Unpublished Ph.D. dissertation, University of Texas at Austin, 1973.

theorizing on the multivariate nature of communication effects has been inadequate in specifying the magnitude of effects and the relative importance of the communication stimulus in the attainment of effects. This may have been due, in part, to a reliance on statistical techniques which did not directly yield estimates of relative magnitudes and on verbal-pictorial models of communication which were not easily operationalized in quantitative studies. The most important implication of the present study is that models constructed with the use of multiple regression analysis and the mathematical notation associated with this technique provide a conceptual framework which allows for direct mathematical operationalization, estimates of relative magnitudes as well as directions of effects, and a multivariate view of communication.

Although the present study did not include investigation of complex relationships among the independent variables, this decision was based more on limitations of the data base than on limitations of the technique. Curvilinear relationships of predictors to criterion scores were investigated, and a significant curvilinear relationship was found between English Science pretest and posttest scores. This result, along with the frequency of significant complex relationships generally found in research on mediated communication, implies that further research should be conducted in which complex relationships are studied.

The simple additive relationships which were investigated

in this study provide results which confirm and expand previous theorizing on educational television. Previously it could be said that educational television was an effective medium for instruction in some content areas. This was confirmed in the present study. Furthermore, the present study provides initial answers to some of the questions raised earlier by Schramm (1962) regarding how educational television can be effectively articulated into the classroom environment. In the case of a bilingual program series, for instance, classroom activities should be conducted in the same language in which the program material is presented. Where the series has an impact, effects appear to be independent of the sex of the viewer. However, effects do not appear to be independent of the type of classroom (bilingual or monolingual curriculum), nor the background and type of teaching staff. These conclusions are summarized concisely in the linear model notation exhibited in Table 25.

Suggestions for Further Research

Future research on the learning effects of educational television could profit from the inclusion of more detailed measures of independent variables. In the present study, the measure of supplementary activities, for example, was limited to whether activities were conducted, and, if so, whether the language of activities was Spanish or English. Numerous other variables, mentioned above, such as production techniques, as well as

complex relationships among variables also need to be investigated.

It is also strongly suggested that contracts for the evaluation of specific program series require that the evaluation be directed toward the construction of linear models. Evaluation conducted in this manner offers considerable potential for insight into the actual effects of the program series. Such evaluation would also contribute significantly to the ultimate construction and integration of a body of theory on educational television.

APPENDIX A

INSTRUMENTS

CARRASCOLENDAS III

EXAMEN EN ESPAÑOL [1:1]

Nombre_____ Nº.de identificación_____[2,3,4]

Primer Examen [5:1]

Encierre uno de estos en un círculo	Encierre uno de estos en un círculo

Orden [6] 1 Primero
2 Segundo

Grado: [7] 1 Primero
2 Segundo
3 Jardín Infantil

Preguntas para que el niño se sienta cómodo

¿Cómo te llamas?
¿Cuántos años tienes?
¿Cuántas personas hay en tu familia?

	Perfecto	Inducido	Parcial	Error; nada		Español	Mixto	Inglés
¿Cómo se llaman tu papá y tu mamá?*	[8] 4	3	2	1	[9]	3	2	1
¿Cuál es tu dirección?*	[10] 4	3	2	1	[11]	3	2	1
¿Qué idiomas hablas?* *español e inglés*	[12] 4	3	2	1	[13]	3	2	1

CARRASCOLENDAS III

ENGLISH TEST [1:2]

Child's Name_____ I.D. Number 221 [2,3,4]

Pretest [5:1]

CIRCLE ONE

Order: [6] 1 First
2 Second

CIRCLE ONE

Grade Level: [7] 1 First
2 Second
3 Kindergarten

QUESTIONS TO ASK CHILD TO PUT HIM AT EASE

What is your name?

How old are you?

How many people are in your family?

		Perfect	Prompted	Partial	Wrong; none		English	Mixed	Spanish
What is your address?*	[8]	4	3	2	1	[9]	3	2	1
What are the names of your mother and father? *	[10]	4	3	2	1	[11]	3	2	1
What languages do you speak? *	[12]	4	3	2	1	[13]	3	2	1

CARRASCOLENDAS III

EXAMEN EN ESPAÑOL [1:1]

Nombre_____ Nº. de identificación_____[2,3,4]

Segundo Examen [5:2]

Encierre uno de estos en un círculo

Orden [6] 1 Primero
2 Segundo

Encierre uno de estos en un círculo

Grado: [7] 1 Primero
2 Segundo
3 Jardín Infantil

Preguntas para que el niño se sienta cómodo

¿Cómo te llamas?
¿Cuántos años tienes?
¿Cuántas personas hay en tu familia?

	Perfecto	Inducido	Parcial	Error; nada		Español	Mixto	Inglés
¿Qué idiomas hablas?* *español e inglés*	[8] 4	3	2	1		[9] 3	2	1
Pinta un tercio de la pelota. (pelota dividida en tercios)	[10] 4	3	2	1		[11:0]		

CARRASCOLENDAS III

ENGLISH TEST [1:2]

Child's Name_____ I.D. Number_____[2,3,4]

Post-test [5:2]

CIRCLE ONE	CIRCLE ONE

Order: [6] 1 First
2 Second

Grade Level: [7] 1 First
2 Second
3 Kindergarten

QUESTIONS TO ASK CHILD TO PUT HIM AT EASE

What is your name?

How old are you?

How many people are in your family?

		Perfect	Prompted	Partial	Wrong; none		English	Mixed	Spanish
What languages do you speak?*	[8]	4	3	2	1	[9]	3	2	1
Which of these names is the name of a place: armadillo, San Antonio, mosquito? *San Antonio*	[10]	4	3	2	1	[11]	3	2	1

3FEE8

CARRASCOLENDAS SITE STATUS REPORT

1. Please describe how you obtained your test school(s) and any problems you have encountered as well as changes in your original plan.

2. What procedures did you undertake to solve any problems or difficulties?

3. When was pretesting completed? _____

4. Did the local television station or cable company cooperate with your efforts? (Please describe)

5. Please indicate the viewing status of the series.

   ____Subjects (K, 1, 2) watch the series in one classroom
   ____Subjects watch the series in different classrooms in the same school
   ____Subjects watch the series in different schools
   ____Other (please specify)_____

6. How is the television station airing the show? That is, is the broadcasting done under the auspices of PBS, cable tv, or were other arrangements made?_____

7. Please indicate below on which particular day each show will be televised. Be sure to note if any programs will be missed during Thanksgiving. Also, since post-testing begins two weeks to 10 days before Christmas vacation, what programs will not have been seen when post-testing begins.) Do this for programs 1-30.

PROGRAM NUMBER	DATE	PROGRAM NUMBER	DATE	PROGRAM NUMBER	DATE
1	____	11	____	21	____
2	____	12	____	22	____
3	____	13	____	23	____
4	____	14	____	24	____
5	____	15	____	25	____
6	____	16	____	26	____
7	____	17	____	27	____
8	____	18	____	28	____
9	____	19	____	29	____
10	____	20	____	30	____

8. When do you plan to begin post-testing? _____

9. When will you begin the Parent Attitude Survey? _____

10. What is the general atmosphere that you find yourself working in (congenial, tense, etc.)? In particular, do you foresee any potential problems such as teacher strikes, etc?

_____

_____

_____

_____

_____

School Name

NAME OF CHILD ABSENCES (Month and Date)

Grade Level

(Name) (Dates of Absences)

Site identification_____

NONVIEWER CLASSROOM INFORMATION

Name:_____ Grade Level:_____

Position:_____ Number of children in class:_____

1. Do you speak Spanish? (Check one)

___fluently ___moderately ___limitedly ___English only

2. What is your educational background? (Check one)

____Teacher certificate, Elementary Education
____Temporary teacher certificate, Elementary Education
____Teacher certificate, other:_____
____other:_____

(Check one)

____Bachelor degree in Elementary Education
____Bachelor degree in Spanish
____Bachelor degree in Bilingual Education
____Bachelor degree in Foreign Language Education
____Master's degree
____other:_____

3. How many years have you taught school? _____

4. Does the class receive any bilingual instruction?

(Check one)
____daily
____once a week
____twice a week
____three times a week
____four times a week

(Give approximate totals)
____# hours per day
____# hours per week

5. Does the class participate in any televised instruction? ___yes ___no
If yes, give name:_____

6. Number of children in class participating in CARRASCOLENDAS experiment: _____

7. Children's identification numbers in this classroom: _____

Site identification_____

VIEWER CLASSROOM INFORMATION

Name:_____ Grade Level:_____

Position:_____ Number of children in class:_____

1. Do you speak Spanish? (Check one)
   ____fluently ____limitedly
   ____moderately ____English only

2. What is your educational background? (Check one)
   ____Teacher certificate, Elementary Education
   ____Temporary teacher certificate, Elementary Education
   ____Teacher certificate, other:_____
   ____other:_____

   (Check one)
   ____Bachelor degree in Elementary Education
   ____Bachelor degree in Spanish
   ____Bachelor degree in Bilingual Education
   ____Bachelor degree in Foreign Language Education
   ____Master's degree
   ____other:_____

3. How many years have you taught school? _____

4. Does the class receive any bilingual instruction?
   (Check one)
   ____daily
   ____once a week
   ____twice a week
   ____three times a week
   ____four times a week

   (Give approximate totals)
   ____# hours per day
   ____# hours per week

5. Does the class participate in any other televised instruction besides CARRASCOLENDAS?
   ___no ___yes If yes, give name:_____

6. What days do you view CARRASCOLENDAS?
   ____Monday ____Tuesday ____Wednesday ____Thursday ____Friday

7. What time do you view the series? _____

8. Do you have a Teacher Guide for CARRASCOLENDAS? ___yes ___no

9. Do you plan to initiate class activities about CARRASCOLENDAS before viewing the program? (Check one) ____always ____sometimes ____rarely ____never

10. Do you plan to initiate class activities about CARRASCOLENDAS after viewing the program? (Check one) ____always ____sometimes ____rarely ____never

11. Will activities be conducted in Spanish or English? (Check one)
    ____mainly Spanish ____half Spanish and half English
    ____mainly English ____no activities

12. Number of children in class participating in CARRASCOLENDAS experiment:_____

13. Children's identification numbers in this classroom:_____

GENERAL INFORMATION

Please fill in the blanks below.

Name_____ School Name_____

Address_____ Address_____

_____ _____

Social Security #_____ Grade Level_____

What is the ethnic composition of your class? (Approximate %)

___% Mexican-American ___% Black ___% Other_____
___% Anglo ___% Indian 100% TOTAL

What percentage of the pupils viewing the program with you speak:

SPANISH	ENGLISH
___% Fluently	___% Fluently
___% Moderately	___% Moderately
___% Limitedly	___% Limitedly
___% Comprehend only	___% Comprehend only
___% None	___% None
100% TOTAL	100% TOTAL

Do you speak Spanish?
___ Fluently
___ Moderately
___ Limitedly
___ No Spanish

Do you have a teacher aide (or team teacher) who speaks Spanish?
___ No aide
___ Aide who does not speak Spanish
___ Aide who speaks Spanish

What is the extent of Spanish instruction in your school? (Please be specific.)

_____

_____

_____

Has your class ever viewed a television series in class before? ___Yes ___No

Which one: _____

Are you viewing CARRASCOLENDAS in color? ___Yes ___No

Please write a brief description of the situation in which you view CARRAS-COLENDAS--how often viewed, at what hour, and under what conditions (type of room, number viewing, etc. Use back of sheet if additional space is needed.)

_____

_____

_____

APPENDIX B

INTERVIEWER RELIABILITY

Interviewer Reliability

1. If you asked a child to color 1/3 of a circle (divided into thirds), and he colored 2/3 of the circle, you would score:*

   4 3 2 (2) *1 (11) NR=(3)

2. When you ask the child "What is your address?", and he responds with the name of the city; and, when you repeat the question again, he does not respond further, you would score:

   4 3 2 (2) *1 (14)

3. If a child is being tested on an objective of the use of on, you ask him, "Where is the boy riding?" (visual of a boy on a bus), and he responds "to school" or "to the store," and you ask, "Yes, but where is he?" and he responds, "in the bus," you would score:

   4 3 2 (2) *1 (13) NR=(1)

4. If to the same question (3) after following the same procedure, he responds by answering, "on the bus," you would score:

   4 (1) *3 (13) 2 (1) 1 NR=(1)

5. If you ask the child "What languages do you speak?", and he only responds, "English" (on further checking you discover that he does not speak Spanish), you would score:

   *4 (13) 3 2 (2) 1 (1)

6. If a child is asked the name of his parents, and he does not respond, you would score:

   Content: 4 3 2 1 (3) Language: 3 (3) 2 1

   OR

   *Content: 4 3 2 1 (13) Language: No mark in language column

I conducted the test interview in (circle one):

Spanish (9) English (7)

*Correct score for each item. Number of interviewer responses indicated in parentheses.

APPENDIX C

STATISTICAL TABLES

1. Viewing frequency
2. Activities (any)
3. Activities (Spanish)
4. Activities (English)
5. Color TV
6. Sex
7. Teacher MA
8. Teacher experience
9. Teacher Spanish
10. Aide
11. Aide Spanish
12. Bilingual instruction (days)
13. Bilingual instruction (hours/day)
14. Bilingual instruction (hours/week)
15. Mexican-American percentage
16. Class size
17. Sesame Street
18. Grade
19. Educational TV
20. Viewing frequency squared
21. Teacher experience squared
22. Teacher Spanish squared
23. Bilingual instruction (days) squared
24. Bilingual instruction (hours/day) squared
25. Bilingual instruction (hours/week) squared
26. Mexican-American percentage squared
27. Class size squared
28. Grade squared
29. Educational TV squared
30. Spanish pretest Self Concept
31. Spanish pretest Language Skills
32. Spanish pretest History/Culture
33. Spanish pretest Science
34. Spanish pretest Total
35. Spanish pretest Phoneme/Grapheme
36. Spanish pretest Math
37. Spanish posttest Self Concept
38. Spanish posttest Language Skills
39. Spanish posttest History/Culture
40. Spanish posttest Science
41. Spanish posttest Total
42. Spanish posttest Phoneme/Grapheme
43. Spanish posttest Math
44. English pretest Self Concept
45. English pretest Language Skills
46. English pretest History/Culture
47. English pretest Science
48. English pretest Total
49. English posttest Self Concept
50. English posttest Language Skills
51. English posttest History/Culture
52. English posttest Science
53. English posttest Total
54. Spanish pretest History/Culture squared
55. English pretest Science squared

Prevalidation Sample

Variable Number	Means	Standard Deviations	Variance	Range of Observed Values
1.	18.8039	10.4432	109.0496	0-27
2.	.7451	.4358	.1899	0-1
3.	.5000	.5000	.2500	0-1
4.	.6275	.4835	.2338	0-1
5.	.2353	.4242	.1799	0-1
6.	.4755	.4994	.2494	0-1
7.	.1422	.3492	.1219	0-1
8.	7.3284	8.8365	78.0833	0-38
9.	2.1373	1.0759	1.1576	0-3
10.	.5882	.4922	.2422	0-1
11.	.4853	.4998	.2498	0-1
12.	3.0490	2.3405	5.4780	0-5
13.	1.9069	2.3381	5.4668	0-6
14.	9.5392	11.7370	137.7583	0-30
15.	62.3627	42.8737	1838.1527	22-100
16.	24.3922	6.0052	36.0619	14-33
17.	.1422	.3492	.1219	0-1
18.	2.0049	.8195	.6715	1-3
19.	.5931	.9981	.9962	0-4
20.	462.6471	272.4144	74209.5813	0-729
21.	131.7892	320.3143	102601.2742	0-1444
22.	5.7255	3.6304	13.1795	0-9
23.	14.7745	11.9122	141.9001	0-25
24.	9.1029	13.9475	194.5335	0-36
25.	228.7549	348.4879	121443.8321	0-900
26.	5727.2647	4395.0416	19316390.3711	0-10000
27.	631.0392	221.3151	48980.3710	196-1089
28.	4.6912	3.3133	10.9782	1-9
29.	1.3480	3.1718	10.0602	0-16
30.	2.3534	.8916	.7949	1.00-4.00
31.	2.6140	.7737	.5986	1.00-3.87
32.	1.5999	.5404	.2920	1.00-3.50
33.	2.1458	.8349	.6970	1.00-4.00
34.	2.3756	.6512	.4241	1.00-3.75
35.	2.4299	.7901	.6243	1.00-4.00
36.	2.6033	.8677	.7528	1.00-4.00
37.	2.5668	.8978	.8060	1.00-4.00
38.	2.8367	.7688	.5910	1.00-3.81
39.	2.0699	.8386	.7033	1.00-4.00
40.	2.2649	.8341	.6957	1.00-4.00
41.	2.6460	.6861	.4708	1.05-3.79
42.	2.6591	.8348	.6969	1.00-4.00
43.	2.9477	.8558	.7324	1.00-4.00
44.	2.3606	.7396	.5470	1.00-4.00
45.	2.4983	.6621	.4384	1.00-3.81
46.	1.7165	.5814	.3381	1.00-3.00
47.	2.2575	.7159	.5124	1.00-3.59
48.	2.3130	.5942	.3531	1.07-3.52
49.	2.6827	.8072	.6516	1.00-4.00
50.	2.7558	.7002	.4902	1.06-3.81
51.	2.0100	.5680	.3226	1.00-3.50
52.	2.6037	.7717	.5955	1.00-3.94
53.	2.6227	.6402	.4099	1.25-3.68
54.	2.8516	2.0030	4.0120	1.00-12.25
55.	5.6087	3.1902	10.1774	1.00-12.88

Cross-Validation Sample

Variable Number	Means	Standard Deviations	Variance	Range of Observed Values
1.	18.6471	10.5442	111.1794	0-27
2.	.7451	.4358	.1899	0-1
3.	.4951	.5000	.2500	0-1
4.	.6275	.4835	.2338	0-1
5.	.2304	.4211	.1773	0-1
6.	.4559	.4980	.2481	0-1
7.	.1569	.3637	.1323	0-1
8.	7.5931	9.0368	81.6629	0-38
9.	2.1618	1.0610	1.1258	0-3
10.	.5637	.4959	.2459	0-1
11.	.4804	.4996	.2496	0-1
12.	3.0245	2.3461	5.5043	0-5
13.	1.8824	2.3318	5.4371	0-6
14.	9.4314	11.6938	136.7453	0-30
15.	61.2647	43.2706	1872.3417	22-100
16.	24.3088	5.9448	35.3409	14-32
17.	.1373	.3441	.1184	0-1
18.	1.9902	.8224	.6764	1-3
19.	.5931	.9932	.9864	0-4
20.	458.8922	273.9051	75023.9982	0-729
21.	139.3186	328.0957	107646.8151	0-1444
22.	5.7990	3.6372	13.2292	0-9
23.	14.6520	11.9349	142.4426	0-25
24.	8.9804	13.9171	193.6859	0-36
25.	225.6961	347.7241	120912.0251	0-900
26.	5625.7059	4412.1623	19467175.8547	0-10000
27.	626.2598	216.9667	47074.5649	196-1024
28.	4.6373	3.3190	11.0155	1-9
29.	1.3382	3.1651	10.1079	0-16
30.	2.2912	.9297	.8644	1.00-4.00
31.	2.5111	.8581	.7363	1.00-3.80
32.	1.6097	.6081	.3698	1.00-4.00
33.	2.0674	.8413	.7078	1.00-4.00
34.	2.3180	.7398	.5473	1.00-3.77
35.	2.3850	.8822	.7783	1.00-4.00
36.	2.6062	.9368	.8777	1.00-4.00
37.	2.4990	.9791	.9586	1.00-4.00
38.	2.7739	.8329	.6937	1.00-3.87
39.	2.0760	.8675	.7525	1.00-4.00
40.	2.2721	.9123	.8322	1.00-4.00
41.	2.6029	.7625	.5814	1.00-3.95
42.	2.5747	.9268	.8589	1.00-4.00
43.	2.9493	.9186	.8439	1.00-4.00
44.	2.5139	.7017	.4923	1.00-4.00
45.	2.5827	.5693	.3242	1.19-3.88
46.	1.7475	.5753	.3310	1.00-3.00
47.	2.3224	.6594	.4348	1.00-3.82
48.	2.3932	.5196	.2699	1.14-3.70
49.	2.7900	.6395	.4089	1.00-4.00
50.	2.9066	.6248	.3903	1.19-4.00
51.	2.0327	.5276	.2783	1.00-3.50
52.	2.7047	.6524	.4256	1.00-3.82
53.	2.7348	.5325	.2836	1.02-3.73
54.	2.9609	2.3196	5.3804	1.00-16.00
55.	5.8283	3.1194	9.7305	1.00-14.62

Correlations*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1		89	52	65	31	-06	12	-14	07	46	40	09	13	12	66	16	09	04	23	99	-19	04	07	10	09	59	05	03	19	-01
2	92		58	76	32	-05	13	-13	03	55	45	03	03	02	73	23	-03	08	19	86	-18	-00	01	-01	-01	65	14	06	18	-10
3	53	58		28	27	-02	06	07	50	55	60	60	41	42	68	17	-05	19	00	50	00	48	58	31	32	69	12	17	09	15
4	67	76	28		28	-01	05	-13	-11	28	15	-17	-01	-03	45	21	07	06	32	62	-11	-13	-20	-03	-04	36	17	07	27	-10
5	35	32	28	28		01	-04	-06	11	34	43	25	36	33	37	12	-22	-09	07	34	-09	02	23	34	33	35	10	-10	06	09
6	-01	02	05	02	07		-18	16	10	-11	-03	02	04	04	04	-12	18	-04	11	-06	17	14	02	06	06	03	-11	-05	13	-02
7	14	14	10	05	-03	01		07	-08	24	12	-05	07	08	02	-00	-17	-08	-22	11	-00	-10	-07	05	06	-03	-06	-08	-17	-05
8	-13	-13	10	-13	-05	-02	05		05	-20	-19	-21	-04	-04	-15	00	21	-02	27	-12	05	06	-23	02	02	-14	-03	-05	41	-32
9	09	05	53	-09	12	19	00	12		33	44	63	49	48	43	-21	23	-26	-04	04	02	97	60	43	43	49	-21	-26	03	04
10	54	61	54	34	32	10	28	-20	27		85	38	39	40	64	-03	-05	-13	-28	44	-27	31	39	30	30	61	-05	-13	-28	11
11	43	48	62	18	43	10	17	-17	45	81		47	37	38	65	-02	-21	-18	-34	40	-23	41	47	25	25	65	-02	-19	-30	03
12	12	07	62	-14	26	14	-00	-18	64	33	47		65	65	41	-10	-11	11	-23	08	-27	61	99	53	54	46	-06	09	-18	33
13	17	05	42	01	35	08	10	-03	49	36	37	65		100	23	-07	12	-19	-17	11	-13	50	65	97	97	23	-05	-21	-16	19
14	16	05	43	-00	32	09	11	-03	48	37	38	65	100		22	-08	12	-19	-19	10	-12	50	66	97	97	22	-06	-20	-18	18
15	67	75	69	47	37	14	07	-12	45	63	66	41	23	22		06	03	07	11	63	-16	40	37	13	13	98	-04	05	15	05
16	17	22	17	20	17	-11	-02	02	-14	04	03	-05	02	02	07		-26	19	05	16	01	-20	-08	-07	-07	01	95	17	06	02
17	10	-02	-07	08	-23	09	-17	22	21	-06	-23	-13	10	11	01	-25		-13	51	04	20	28	-12	18	18	04	-35	-13	44	-05
18	04	10	16	09	-09	-07	-07	-07	-25	-12	-19	13	-18	-17	05	11	-14		20	06	03	-26	13	-22	-22	08	19	99	15	37
19	26	22	-00	35	09	07	-23	26	-04	-24	-32	-22	-17	-19	11	05	50	19		21	26	-06	-28	-14	-14	11	01	18	93	-11
20	98	88	50	63	40	-04	15	-12	06	52	42	10	16	15	64	16	05	06	24		-18	01	06	07	08	57	05	05	18	00
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22	09	05	51	-09	02	16	-03	12	97	27	42	62	50	50	43	-13	26	-24	-05	06	06		59	46	46	45	-20	-27	01	03
23	09	04	60	-17	24	13	-03	-20	61	34	47	99	65	66	37	-03	-14	14	-28	08	-27	59		55	55	42	-04	11	-26	34
24	14	01	32	-01	33	08	07	02	43	27	25	54	97	97	13	02	17	-20	-14	13	-07	46	55	100		12	-06	-23	-14	15
25	14	00	33	-02	32	08	08	02	43	28	26	54	97	97	13	02	17	-20	-14	13	-07	46	55	100		12	-06	-23	-14	15
26	60	67	71	38	34	14	02	-12	51	58	66	46	24	23	98	02	02	06	12	57	-13	48	42	12	12		-09	06	15	08
27	06	14	13	17	10	-11	-07	-03	-17	02	02	-02	03	02	-04	95	-35	12	02	05	-05	-16	00	01	01	-08		18	04	03
28	04	09	15	10	-09	-07	-07	-10	-25	-12	-19	11	-19	-18	03	10	-14	99	18	04	-04	-25	12	-21	-21	04	12		11	38
29	21	20	08	29	07	11	-17	41	02	-27	-30	-18	-16	-18	15	07	43	15	93	20	43	02	-25	-14	-15	15	04	11		-15
30	-10	-12	09	-14	07	14	-03	-19	06	04	01	35	19	18	05	00	-04	38	-07	-09	-20	04	36	13	13	09	02	37	-08	
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32	02	02	14	-03	09	13	-05	-06	12	10	01	30	20	19	16	-02	01	36	01	03	-09	10	31	16	15	18	-04	35	-03	61
33	-06	-01	09	-08	-08	07	13	-14	-03	08	-02	19	03	03	01	08	-12	43	-13	-06	-15	-03	20	-01	-01	02	08	43	-14	70
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38	01	00	18	-13	06	14	01	-14	06	04	02	40	21	20	15	10	-08	38	-03	01	-16	09	39	15	15	16	11	36	-00	72
39	20	10	27	-05	19	11	-14	-14	22	13	12	46	37	36	29	02	05	27	-02	19	-17	22	46	32	32	33	-05	26	-03	58
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42	09	15	21	07	-09	13	08	-09	-01	11	01	20	-11	-10	19	-01	01	57	11	07	-06	-02	19	-16	-16	20	-02	56	12	55
43	05	09	16	01	01	11	05	-22	-12	05	-03	28	-03	-03	13	08	-22	59	01	06	-21	-10	28	-09	-09	13	10	55	03	59
44	01	01	-03	01	-15	09	-05	-01	-10	-11	-18	01	-12	-12	02	-05	06	47	18	02	03	-07	01	-11	-11	02	-06	46	12	29
45	04	05	-06	11	-08	-02	11	05	-10	-02	-18	-10	-10	-11	00	-04	14	25	19	04	06	-06	-12	-08	-09	-02	-09	25	15	08
46	02	00	-03	04	19	12	-11	-14	-07	02	-07	18	14	12	10	03	-04	32	07	03	-12	-06	18	12	12	09	03	33	03	42
47	04	06	-05	12	-02	-05	02	-02	-17	-05	-17	-04	-04	-05	02	07	-01	45	19	07	01	-12	-04	-01	-02	-02	08	43	14	25
48	03	05	-06	10	-04	-00	03	00	-14	-05	-19	-03	-06	-07	02	01	05	43	20	05	03	-10	-04	-04	-05	-00	-01	42	15	25
49	01	-01	-02	-01	-19	07	-16	07	05	-16	-13	03	-16	-16	12	-15	17	36	26	01	12	09	01	-15	-15	14	-20	34	25	20
50	12	14	00	17	-07	08	-03	06	01	-02	-10	-05	-11	-12	15	-11	20	29	31	12	13	05	-08	-10	-10	15	-17	28	29	07
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52	15	19	13	17	-06	-01	-00	10	02	02	04	04	-04	-05	24	02	01	41	24	15	13	08	03	-05	-05	22	00	39	24	09
53	13	15	07	14	-07	04	-05	07	02	-02	-04	03	-07	-08	22	-07	11	41	28	13	13	07	01	-08	-08	21	-11	39	27	14
54	04	05	15	01	06	13	-05	-04	14	11	-02	28	21	19	17	-03	07	34	06	05	-08	12	29	17	16	20	-07	34	02	55
55	02	04	-07	12	-04	-07	00	-02	-21	-09	-22	-08	-06	-08	-02	10	-03	47	20	04	01	-16	-07	-04	-04	-06	12	46	14	26

*Prevalidation data is below the diagonal, with cross-validation data above; decimal points have been omitted.

Correlations (Continued)*

Variable	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
1	-04	-05	-01	-01	09	-02	-02	01	15	04	04	02	01	-01	00	06	05	03	10	08	09	09	11	-05	05
2	-10	-11	-04	-03	12	-02	-09	-05	03	-01	-01	05	-01	-02	04	01	05	04	05	12	06	10	12	-10	05
3	13	15	17	20	27	15	15	21	27	21	26	26	18	04	-07	12	-06	-03	07	-03	13	05	04	15	-05
4	-16	-19	-10	-10	03	-08	-15	-16	-10	-11	-11	-01	-09	01	14	01	14	13	05	19	06	14	17	-16	15
5	03	04	00	-01	-04	-07	13	10	13	11	05	-10	03	-14	-27	19	-07	-14	-09	-14	13	-07	-09	01	-08
6	-09	-06	-08	-11	-17	-08	-03	-02	-05	-07	-04	-06	-01	09	06	-02	-08	-00	15	06	04	-00	06	-04	-09
7	06	-06	09	07	15	08	02	06	-12	00	07	12	11	-11	06	-16	-01	-03	-20	-06	-17	-02	-09	-08	-03
8	-14	-12	-13	-17	-10	-13	-23	-19	-14	-16	-18	-09	-14	02	11	-10	01	04	04	10	-12	09	07	-08	-01
9	-03	07	02	-06	-07	-16	04	02	17	01	-02	-06	-15	-07	-26	-01	-32	-27	03	-18	00	-14	-14	07	-31
10	03	11	11	09	18	01	11	09	17	09	13	18	03	-07	-12	02	-09	-10	-01	-06	06	-02	-03	11	-08
11	-02	00	03	-00	04	-06	05	07	11	05	07	08	-00	-13	-22	-04	-21	-22	-01	-10	08	-04	-05	-02	-21
12	27	28	17	24	13	17	30	32	38	22	31	18	23	02	-29	15	-17	-17	05	-22	16	-06	-09	26	-17
13	16	19	04	08	-02	-03	23	22	37	09	16	00	03	-10	-25	14	-15	-17	-09	-24	09	-11	-16	18	-13
14	16	19	04	08	-01	-03	23	22	37	09	16	01	03	-10	-25	14	-16	-17	-10	-24	08	-11	-16	18	-14
15	-04	05	01	04	15	01	02	03	17	05	08	12	03	02	-12	11	-07	-06	17	02	15	08	09	06	-07
16	09	03	11	11	12	15	02	09	00	11	08	05	12	-01	-01	06	07	04	-09	-04	03	-04	-04	02	07
17	-12	00	-02	-13	-10	-20	-03	-11	09	-06	-08	-03	-20	05	07	00	-05	01	13	04	-02	-06	01	05	-03
18	47	39	40	58	53	66	29	37	28	32	51	53	58	46	41	37	51	55	44	36	40	45	49	39	51
19	-07	-06	-03	-07	-04	-05	-08	-07	-05	-04	-05	-02	-03	10	19	09	18	20	17	21	05	14	19	-02	18
20	-01	-03	00	01	09	00	-00	04	16	04	06	02	04	-00	00	08	07	05	10	08	12	10	11	-03	07
21	-17	-14	-13	-17	-09	-11	-24	-23	-17	-16	-17	-04	12	06	14	-11	04	07	11	17	-12	14	14	-11	02
22	-03	07	00	-07	-10	-15	03	01	17	-02	-03	-07	-16	-04	-23	-02	-29	-25	04	-18	-00	-12	-13	07	-29
23	28	30	19	26	14	19	30	33	39	23	32	19	23	03	-28	16	-16	-16	05	-22	18	-06	-09	28	-15
24	15	17	03	05	-05	-06	20	19	34	07	12	-05	-00	-09	-24	12	-12	-15	-11	-23	07	-11	-16	16	-11
25	15	17	03	05	-05	-05	20	19	34	07	12	-04	00	-10	-24	12	-13	-16	-11	-23	07	-11	-16	16	-11
26	-02	09	02	06	17	03	05	06	20	08	11	15	05	03	-13	13	-09	-07	19	01	18	07	09	10	-09
27	10	00	11	10	08	14	02	10	-03	10	07	03	10	-00	01	07	10	06	-12	-03	05	-01	-03	-00	11
28	46	39	41	58	53	65	29	36	27	32	50	54	56	46	42	37	50	56	44	37	41	44	49	39	51
29	-10	-10	-06	-11	-08	-09	-09	-10	-06	-05	-07	-03	-04	05	17	11	13	16	13	19	01	14	17	-06	13
30	77	73	71	82	58	66	80	77	71	69	80	56	65	43	08	52	25	31	28	01	40	14	17	56	27
31		72	77	92	67	81	73	84	66	63	82	57	74	40	10	48	27	32	23	-01	38	15	16	63	27
32	64		66	78	54	64	67	66	78	57	70	46	55	37	10	55	27	32	21	01	46	16	17	97	28
33	75	56		82	64	69	65	69	56	66	72	56	61	35	13	35	23	28	15	04	30	09	12	60	24
34	92	71	79		86	92	72	82	65	67	87	71	80	45	21	49	36	42	28	11	41	23	25	70	36
35	60	44	56	81		77	50	61	43	52	71	72	66	36	23	31	31	36	25	17	27	20	25	48	33
36	74	53	62	85	61		57	70	50	54	78	68	80	45	32	42	41	48	30	20	38	11	34	56	41
37	66	60	59	67	41	45		85	72	76	86	55	68	33	00	45	18	22	19	-09	35	08	08	59	19
38	78	58	64	75	48	58	78		70	77	93	63	80	31	01	41	18	21	18	-07	32	11	09	57	19
39	59	67	46	59	37	39	66	63		62	74	43	52	35	-03	57	19	23	21	-09	45	09	10	73	21
40	58	50	56	61	41	47	66	71	58		80	58	62	29	04	40	21	23	16	-02	31	12	11	51	22
41	80	66	71	85	63	66	82	91	71	78		82	90	42	16	46	31	37	27	07	39	23	23	62	32
42	59	48	59	72	67	51	55	61	43	57	82		73	39	32	28	33	41	29	27	27	30	34	41	34
43	66	47	59	74	57	78	57	72	43	60	83	67		41	25	36	38	42	26	15	33	31	30	47	38
44	25	25	24	35	28	42	29	26	20	26	36	35	40		46	42	55	70	63	44	37	51	58	36	53
45	08	11	09	20	25	28	07	03	02	08	19	28	26	65		15	72	86	45	74	18	62	70	12	70
46	40	49	29	43	27	37	49	44	43	32	46	27	41	43	32		38	47	27	03	59	20	23	54	40
47	28	28	23	37	29	44	30	25	17	23	35	33	41	73	73	49		93	46	56	35	69	68	29	99
48	26	28	22	37	32	43	29	26	18	23	36	36	41	82	89	55	94		57	66	40	71	76	34	92
49	13	17	16	24	20	32	21	17	15	20	27	29	31	66	59	31	56	64		56	42	64	76	21	47
50	03	10	09	18	26	26	09	09	02	11	20	30	28	63	78	32	63	76	74		18	73	88	03	53
51	39	41	23	42	32	40	45	42	44	33	47	31	43	40	30	58	44	46	47	41		37	45	45	36
52	17	20	13	25	22	34	10	19	07	17	25	28	33	62	64	33	69	73	72	73	43		93	16	66
53	16	21	15	28	28	36	17	20	12	20	30	31	37	70	74	40	72	80	85	91	56	93		18	66
54	57	98	51	64	40	47	55	52	64	46	59	44	41	26	14	45	28	29	19	12	37	21	22		31
55	30	29	26	38	30	45	31	25	17	23	35	33	40	69	68	47	98	90	51	58	40	64	66	29	

*Prevalidation data is below the diagonal, with cross-validation data above; decimal points have been omitted.

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VITA

Monty Carlis Stanford was born in Comanche, Oklahoma, on May 14, 1942, the son of Verda Leota Stanford and Curtis Victor Stanford. After completing his work at Lovington High School, Lovington, New Mexico, in 1959, he entered New Mexico State University at Las Cruces, New Mexico. In June, 1964, he received the degree of Bachelor of Arts with a major in English. During the following two years he was employed as manager of KRWG-FM radio station and broadcast laboratory instructor at New Mexico State University. In June, 1966, he received the degree of Bachelor or Arts with a major in journalism from New Mexico State University. At that time, he entered the U. S. Navy Officer Candidate School, where he was commissioned Ensign in September, 1966. After serving as Public Affairs Officer aboard the USS CONSTELLATION (CVA-64) and the Office of the Chief of Information, he was released from active duty with the rank of Lieutenant in January, 1970. He entered the Graduate School of Central Michigan University and was awarded the degree of Master of Arts in speech in August, 1971. He subsequently entered the Graduate School of the University of Texas at Austin. In 1965, he married the former Ruth Anne Brown of Joppa, Maryland. A son, Derek Christopher, was born in October, 1970.

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